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TECH AND SUSTAINABILITY

How the technology sector is driving Australia's transition to a net-zero economy

A White Paper by the Australian Information Industry Association

Use of the AIIA White Paper

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Introduction

The Australian Prime Minister in 2007 cited climate change as the 'great moral challenge of our generation'[1] and for the next 15 years the political and policy climate wars dominated Australian politics. In 2023, with the contentiousness of climate change seemingly behind us, we now have the opportunity for Australia to take a leadership position as global economies and supply chains seek to decarbonise utilising modern technologies. Australia is a signatory to the Paris Agreement and is committed to achieving carbon-neutrality as an economy by 2050 or earlier. On May 20, 2023, President Biden and Prime Minister Albanese announced climate and clean energy as the third substantive pillar of the Australia-U.S. alliance.[2] Further, in the Quad Joint Statement released the same day, the leaders of Australia, Japan, India, and the United States committed to working '*transparently and in open dialogue to implement a practical agenda that delivers sustained economic and social value, is responsive to regional partners, and contributes to global priorities by advancing the United Nations' 2030 Agenda for Sustainable Development and its Sustainable Development Goals, noting the transformational power of technology to help meet these goals*.'[3]

Enter technology: the activating force and common thread between the AIIA's members, as a means of addressing this pressing global problem. Technology serves as the engine of our modern digital economy and the source of not only human productivity, but an agent of human flourishing when leveraged thoughtfully.

Australia is one of the largest emitters of carbon by population given we have a large mining and agricultural sector that supply the global economy. We are in an enviable position to lead the transition to remove carbon from energy and agriculture and the recent federal budget announcement investing in hydrogen fuels is an example of this symbiosis between industry and government to drive the green economy of the future.

Against the backdrop of the current energy mix – whereby coal, oil and natural gas still account for 77%[4] -- and the combined effects of deforestation and greenhouse gases, the race to keep the warming of global temperatures beneath the 'carbon budget' of 1.5 degrees Celsius[5] has become higher stakes than ever, with the IPCC calling for 'deep, rapid and sustained global greenhouse gas emissions reduction' to limit 'abrupt and/or irreversible changes'.[6]

But rather than viewing technology singularly as a contributor to these catastrophic effects, humanity must look to technology as a powerful enabler and tool to be leveraged – given technology's fundamental role as a tool with which to solve humanity's most pressing problems. The promise of technology in the twenty-first century is that the seeds to address the effects of human intervention upon the environment lie within the very same factor, in the form of sophisticated twenty-first century technologies, deployed in an ethical and values-driven way.

The Australian Information Industry Association's (AIIA) members are proactively working sustainability imperatives into the heart of their missions as technology leaders within Australia and the world. Tech companies are working towards this by reducing the energy demands and environmental footprint of technological operations, enabling partners to reduce their carbon emissions, developing climate

1. Rudd, Kevin. National Climate Summit Address. 2007
2. https://www.pm.gov.au/media/australia-united-states-climate-critical-minerals-and-clean-energy-transformation-compact
3. https://www.pm.gov.au/media/quad-leaders-vision-statement-enduring-partners-indo-pacific
4. As of 2021: https://ourworldindata.org/energy-mix
5. https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf p.20
6. https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf p.19

adaptation technologies and contributing to the decarbonisation of the global economy with future-state technologies against the backdrop of the Fourth Industrial Revolution and embracing Fifth Industrial Revolution advances like AI.

Our 2023 Digital State of the Nation Member Survey found that for the majority of tech companies (83%) reducing the carbon footprint of their business is important, however, there seems to be a crucial gap in ability to do so with 58% of responses to another question stating their companies do not collect data or measure their own carbon emissions. The majority of companies surveyed also believe that governments should do more to measure its own carbon impacts of procurements, with 74% answering in the affirmative to this question.

The AIIA over many years has been a proud leader in standing up and reforming product stewardship regimes in Australia and the circular economy and we have a member-led Environment, Sustainability and Governance Policy Advisory Network (PAN) demonstrating member commitment to net carbon zero goals.

Australia needs to plan for a decarbonising economy that will require workforce planning for the skills of the green economy and identifying the correct industry support frameworks and funding to ensure Australia green start-ups can scale and become leading global players. Green skills embedded in every job will form the backbone of this transformation.

This White Paper has been structured into three Chapters. The first focuses on the role of technology in making its own operations less wasteful and more sustainable; getting its 'own house in order' given the immense energy demands of modern digital technologies and services. The way offices of technology companies are run and sustainable business practices also come under the purview of this Section.

The second Chapter examines the role of enterprise technology in helping organisations throughout the supply chain reduce their carbon footprint, the technology inherent in tracking and tracing carbon emissions, technological advancements in reporting and best-practice governance approaches, and carbon abatement technologies.

The third and final Chapter explores Industry 5.0 and the future of work, where green skills will be baked into every role, whether technological, sustainability-focused or otherwise. It looks at the global mission to decarbonise and transform the economy, circular economy, natural capital and the role of emerging and critical technologies in unlocking new horizons for the attainment of sustainability goals.

Throughout the Paper the AIIA has made recommendations to government.

I commend this paper to you, its recommendations to government and the compelling case studies provided by AIIA members. I thank all member companies who worked hard to submit insightful case studies and the White Paper Steering Committee.

I hope this paper will serve as an exemplar for industry and government alike about what can be achieved by technology as we work, as a human society, to transform our digital economy and live sustainably for generations to come.

Simon Bush
CEO
Australian Information Industry Association

Summary of Recommendations

As governments and organisations plan how they will meet their Net-Zero commitments, the AIIA recommends they undertake the following:

Sustainability Benefits of Cloud Adoption

1. For Australia to partner with Pacific Islands nations to assist them on their transition to Cloud and energy-efficient data centres to lower the carbon footprint and energy consumption in-country, as well as uplifting cyber security and digital capability more broadly.
2. For government, in realising the environmental benefits of a delivered cloud-first strategy, to assess modern, energy-efficient clouds and data centres against the impacts of their own on-premise and legacy systems and allocate a comparative carbon footprint score, acting as an exemplar in accelerated cloud adoption.
3. For government to measure and report on the environmental benefits that the digitisation of government services and the digital identity framework drives, noting that the move to digital citizen services such as electronic driver's licences, Medicare cards and immunisation information and trusted paperless interactions will drive both efficiency and sustainability.

The role of Government

4. For government to establish a commercialisation-focused research partnership aligned to the National Reconstruction Fund priority area of renewables and low emissions technologies. The partnership would focus on the development of new climate technologies and capabilities to improve efficiency, create exportable technology and foster collaboration between business and research institutions.
5. For the Government, under the purview of the new Net Zero Authority, to use the energy transition from heavy carbon emitters such as coal and gas to renewables as an opportunity to support the development of new innovative exportable technologies that will drive this transition not just in Australia but internationally to support the transition of the nation's largest emitting sectors to reduce their carbon intensity, including through:
   a. Creating a specific and targeted tax incentive through a green R&D tax incentive;
   b. Providing funding for research and development (R&D) in clean energy technologies to provide a pipeline for the venture capital work of the CEFC's Clean Energy Innovation Fund;
   c. Allocate funding from existing programs from the Department of Industry, Science and Resources specifically for green tech and climate tech start-ups;
   d. Making access to, and support from, the Industry Growth Program and National Reconstruction Fund for start-ups in the 'renewables and low emissions technologies' area a first priority of these initiatives; and
   e. Reviewing and developing regulatory standards to encourage the adoption of green technologies.
6. That government work with industry and academia to activate the data it holds by establishing a collaborative body similar to C4NET in Victoria for the modelling and testing of new solutions, and analysing transition progress, in high-emission or transition-challenged sectors such as energy, transport and resources.
7. For government to support industry in referring to clear metrics and reporting standards that enable a successful economic transition, and promote clear data standards to give industry a clear mechanism to report and measure against.

8. For government to be an exemplar and lead in reporting on the carbon impacts of its own procurements, including ICT. This will require government agencies to invest in the ability to capture and report carbon footprint across its business. Agencies should also report annually and be measured against set KPIs in reducing their carbon footprints.

Future Tech and Industry 5.0

9. That the Government in its design and rollout of the National Robotics Strategy target funding, grants and procurement to applications of robotics in responding to climate disasters, achieving environmental efficiencies in agriculture, managing solar and wind energy applications and planting trees.

10. For the Government, as part of the National Emergency Management Agency's and Australian Government Crisis Coordination Centre's operations, incorporate world-leading applications of AI, including extending applications of AI to disaster management e.g. preparedness and recovery phases.

11. For government and industry to partner to study the sustainability impacts of emerging technologies including Large Language Models that drive generative AI technologies, quantum technology and the significant compute required for these technologies and ensure sustainability goals are incorporated into the execution of National Strategies in quantum technology and artificial intelligence.

Skills and Workforce

12. For government to enhance labour mobility for workers with green skills in renewable energy, climate tech, waste management, disaster resilience and climate adaptation in its priority migration settings and fast-tracking, leveraging alliances and bilateral agreements with Asia-Pacific neighbours such as the Singapore-Australia Green Economy Agreement (Skills and Capabilities for Green Growth area for cooperation).

13. That the Government, through the Department of Employment and Workplace Relations, embed ESG into the Australian Digital Capability Framework (ADCF) as a seventh focus area to enable the development of green microcredentials referring to the ADCF as part of the National Microcredentials Framework and make ESG skills a mandate of the Digital and Tech Skills Compact leading out of the Jobs and Skills Summit, with ESG components of cadetships, digital apprenticeships and work-integrated learning placements prioritised.

14. For government to work with industry to undertake course and skills mapping and to fund scholarships to incentivise and enable students to complete undergraduate and VET courses encompassing renewable energy, waste management, climate tech, and disaster resilience to support the green economy jobs of the future. Through the Net Zero Authority, these scholarships should have a focus on youth and career-changers in areas with a historical economic reliance on emissions-intensive sectors.

How the tech sector is leading the way

Information Communication Technology (ICT) solutions are enabling other industries in the reduction of their environmental footprint. However, the tech sector itself needs to relentless innovate and reform to ensure that it is an exemplar and can offer energy-efficient and innovative solutions to its customers. The greening of ICT must be foremost in our mind while continuing to green other industries through ICT solutions – as Australia has become a digital economy.

At the centre of the "Greening of ICT" process sits the Paris Agreement. Greenhouse gas emission targets set out in the ICT sector must align with the Paris Agreement if real action against climate change is to occur. Using the Agreement as a framework that guides the goal of net-zero emissions, the UN Climate Change Conference in Paris in 2015 (COP21), came to an accord to significantly reduce global greenhouse gas emissions in order to limit the global temperature increase to 2 degrees Celsius in this century, with efforts to limit the increase to 1.5 degrees.[7] A legally binding international treaty, greenhouse gas emissions need to peak by 2025 and decline by 43% by 2030.[8] The ICT sector is perfectly positioned in so many ways to either achieve or exceed such targets and help drive economy wide targets.

Technology businesses are recognising the effects of global warming and are actively implementing initiatives and programs to contribute to achieving net-zero with a number of case studies in this paper showing what is being done. To attain this, technology businesses are looking at their impact on the world, focusing on their energy usage, water consumption and day-to-day operations. Over the past 70 years, the ICT sector has experienced rapid growth, leading to an increasing awareness of its potential environmental impact, particularly with regard to climate change. The ICT sector's carbon footprint has continued to grow, with some estimates placing ICT's share of global greenhouse gas emissions at between 1.8% to 2.8% in 2020, with other studies suggesting ICT's share could be as high as 6.3.[9]

The Sustainable Development Goals

The Sustainable Development Goals (SDGs) were adopted by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development. They consist of 17 goals that aim to end poverty, protect the planet, and promote prosperity and well-being for all by 2030. The goals cover a range of issues such as ending poverty, promoting gender equality, ensuring access to clean water and sanitation, and combatting climate change. Achieving the goals requires action from governments, businesses, civil society, and individuals. The SDGs provide a comprehensive framework for sustainable development.

Recommendation 1. For Australia to partner with Pacific Islands nations to assist them on their transition to Cloud and energy-efficient data centres to lower the carbon footprint and energy consumption in-country, as well as uplifting cyber security and digital capability more broadly.

Several SDGs relate to ICT, such as: SDG 11: Sustainable Cities and Communities, where ICT can be used to improve urban planning, transportation, and environmental management, and to make cities more liveable and sustainable; SDG 9: Industry, Innovation, and Infrastructure, where ICT is a key enabler of innovation and infrastructure development; and SDG 4: Quality Education, where ICT can be used to enhance the quality of education through e-learning, online courses, and educational technology.

On a positive note, not only is the ICT sector acknowledging its need to act, in some instances the targets that technology businesses have set for themselves are more aggressive than the targets set in the Paris Agreement.

To read about one example of ICT organisations setting bold climate commitments, please see *Kyndryl's Path to Net Zero Case Study* and *Telstra's Case Study Telstra Harnessing Digital*

7. https://www.un.org/en/climatechange/paris-agreement
8. https://unfccc.int/process-and-meetings/the-paris-agreement
9. https://www.sciencedirect.com/science/article/pii/S2666389921001884

Technologies to Find a Path to Net Zero **in the case studies appendices.**

One example of this is The Climate Pledge, which was co-founded by Global Optimism and Amazon. All 401 companies who have signed up have all committed to reach net zero carbon by 2040. Signatories to the pledge commit to regular measurement and reporting of greenhouse emissions, implementation of decarbonisation strategies in line with the Paris Agreement through real business change and innovation, and neutralisation of any remaining emissions with additional, quantifiable, real, permanent and socially beneficial offsets to achieve net-zero by 2040.[10]

Another example of industry-set targets was seen in January 2021 when the data centre operators and industry associations in Europe launched the Climate Neutral Data Centre Pact.[11] These operators pledged to make data centres climate-neutral by 2030, with intermediate targets for power usage effectiveness and carbon-free energy.

For a further example of a major telecommunications organisation setting targets to reduce emissions across their business, suppliers and customers, please see ***Harnessing Digital Technologies to Find a Path to Net Zero Case Study*****.**

Energy Efficiency and Reducing Energy Usage: the technological improvements in ICT environments

The ICT sector recognises the crucial role that energy efficiency must play in its operations. Despite contributing to global greenhouse gas emissions, ICTs can also be part of the solution in mitigating emissions across other industries.[12]

While pledges made by ICT companies to reduce their carbon footprint are impressive, more needs to be done. This paper identifies a lack of policy instruments to enforce sector-wide compliance with climate targets.[13]

As such, it is necessary to have a sector-wide framework to keep ICT's carbon footprint in line, with alignment to the Paris Agreement.
The energy efficiency of ICT globally has seen significant improvements over recent decades, primarily due to industry-led R&D efforts aimed at improving the efficiency of devices and infrastructure. As such, technical strategies to improve energy efficiency the world over are being developed alongside non-technical approaches such as regulations. Recent technological improvements in ICT environments have increased energy efficiency and reduced energy use within the sector have led to flow on benefits such as electronic performance, developing new applications to optimise computer hardware and using novel materials and architectures like quantum computing.[14] Other strategies include optimising data centre heat management through consolidation, machine learning, and liquid-submerged servers, and using waste heat generated by data centres to heat buildings and water recycling and closed-loop systems. Modernising communication networks, such as upgrading to fibre optic networks and decommissioning older networks is another method to increase energy efficiency. Power management techniques, such as low-power modes or turning devices off, have already been implemented in user devices and are being developed for network devices. Edge and IoT computing, which involves locating computing resources closer to devices requiring them, may also assist in the reduction of the amount of data that needs to be transferred over the internet that also enables smart home and smart grid monitoring and efficient use of solar systems.

Increasingly cloud and data centre operators are seeking to source the majority of their electricity from renewable sources in order to reduce the impact on the environment. Global ICT companies, such as Google, IBM, and Amazon, have set targets to reach this goal.[15] Google plans to operate on 24/7 carbon-free energy everywhere by 2030, while IBM wants to obtain 75% of the electricity consumed by

10. https://www.theclimatepledge.com/us/en/the-pledge/FAQ
11. https://www.climateneutraldatacentre.net/
12. https://www.itu.int/en/action/environment-and-climate-change/Pages/energy_efficiency-BAK.aspx
13. https://www.sciencedirect.com/science/article/pii/S2666389921001884
14. https://researchbriefings.files.parliament.uk/documents/POST-PN-0677/POST-PN-0677.pdf
15. https://www.eetimes.com/energy-efficiency-is-crucial-for-the-ict-infrastructure/

its IBM Cloud data centres worldwide from renewable sources by 2025 and 90% by 2030. Amazon is on a path to, power its operations with 100% renewable energy by 2025, five years ahead of its initial target of 2030, and reached 85% renewable energy at the end of 2021. AIIA Member CDC Data Centres is already using 100% certified Climate Active Carbon Neutral electricity for its campuses in Canberra and 100% certified Toitu net carbonzero electricity for its campuses in New Zealand. AIIA Member AirTrunk has committed to achieving Net Zero emissions by 2030 for all Scope 1 & 2 emissions, and working toward reducing Scope 3 emissions. AIIA Member GreenSquare DC ha achieved a minimum operational PUE for GreenSquareDC of 1.1, lower than the PUE of 1.5 that the Department of Industry, Science, and Resources reports is expected for state-of-the-art facilities.[16]

Water Positivity

Water positivity or net-positive is a philosophy that goes beyond the reduction of harm and instead emphasises the need for entities to have a net positive impact on society and the environment as it relates to water consumption.[17] When an individual, community, or organisation is water positive, they utilise water resources in a way that sustains healthy ecosystems and water security. Water positivity can include efficient water use, wastewater management, water preservation, investment in water infrastructure, restoration of damaged water systems, and endorsing policies that encourage sustainable water management.[18]

Water positivity is a direct response to the Earth's water being a "scarce resource". That is, despite water covering 70% of the Earth's surface, the availability of freshwater, the type of water necessary for human consumption, is incredibly scarce. Only 3% of the world's water is freshwater, and a significant portion of that is inaccessible due to being trapped in glaciers or otherwise unavailable for human use.[19]

Indian-headquartered ICT company Infosys, as outlined on the recent AIIA delegation to India, as part of their zero-landfill by 2030 commitment, have installed 17 biogas and composting plants within their India campuses, reduced 91% of single-use plastic at campuses since 2018, and achieved 100% organic waste processing. 5 Infosys campuses have had automated solar sludge dryers installed with a capacity to treat 3,500 US tons a year of sludge from wastewater treatment plants – a first-of-its-kind initiative in India.[20] Similarly, Indian-headquartered HCL Tech have committed to achieving Net Zero by 2040, reducing absolute scope 1 & 2 emissions by 50% by 2030, transitioning to 80% of electricity usage to renewable energy by 2030, and achieving zero waste to landfill at all owned facilities by 2025.[21]

A commitment to return more water to communities than organisations use in their direct operations is known as a commitment to be water-positive. Data centres use significant volumes of water so companies such as AWS are making commitments to water-positivity. You can read more about AWS' commitment in: AWS Water-Positive by 2030 Case Study.

Through climate change, pollution and conflict, around 2.7 billion people worldwide face water scarcity for at least one month out of the year, with 1.1 billion people lacking access to water entirely.[22] Not only is freshwater scarce, but many of the ecosystems that rely on it are also under stress. Wetlands, rivers, lakes, and aquifers are either becoming polluted or drying up. Agriculture consumes the most water of any industry, but much of it is wasted due to inefficiencies. Climate change is making this worse, with two-thirds of the world's population expected to face water shortages by 2025.

16. https://greensquaredc.com/sustainability/
17. https://sdgs.un.org/partnerships/net-positive-water-and-carbon-2040
18. https://www.worldwildlife.org/threats/water-scarcity
19. https://www.worldwildlife.org/threats/water-scarcity
20. https://www.infosys.com/content/dam/infosys-web/en/about/corporate-responsibility/esg-vision-2030/waste.html
21. https://www.hcltech.com/sites/default/files/document/open/FY2022_HCL_Sustainability_Report.pdf
22. https://www.worldwildlife.org/threats/water-scarcity

The United Nations Sustainable Development Goal 6 "Clean Water and Sanitation" directly relates to water positivity.[23] This goal encompasses universal access to safe and affordable drinking water, improving water quality, increasing water-use efficiency, and protecting and restoring water-related ecosystems. SDG 6 also aims to tackle issues such as water scarcity, drought and pollution.

Technology and consulting organisations are advancing sustainability in this area by providing farmers with the means to assess their drought resilience through an online, data-rich tool known as DR.SAT. To find out more please view the Deloitte Resilience Drought Self-Assessment Tool (DR.SAT) case study.

Many organisations around the world are striving to become water positive. These organisations are seeking ways to reduce their water consumption and, at the same time, find mechanisms through which to restore water back to the systems they operate in. The technology giants in Silicon Valley are leading the way in water positivity. For example, Microsoft, Facebook and Google all have a goal to replenish more water than they use in their direct operations by 2030.[24] Additionally, in 2022, AWS announced its Water+ commitment to be water positive by 2030, returning more water to communities than it uses in its data centre operations.[25]

Closed-Loop Cooling

Data centres are critical in the ICT world. Housing essential applications and data, these centres include routers, switches, firewalls, storage systems, servers and application delivery controllers. Without data centres, there would be no ICT sector.[26] The problem, however, is that data centres, which generate sizable heat, need to be protected through cooling using significant water and energy resources. The cooling method used depends upon the situation and can include air, water, refrigerants and / or a blend of different methods.[27]

In order to safeguard against damage or downtime, data centres regulate various environmental factors. Temperature control is critical, typically involving a combination of air and liquid cooling methods to maintain suitable temperature ranges for hardware.[28] Computer room air conditioning is used to cool entire server rooms or rows or racks of servers, while liquid cooling directly pumps coolant to processors or immerses servers in coolant. As energy efficiency and sustainability come increasingly to the fore, liquid cooling is gaining popularity due to its reduced energy and water consumption compared to air cooling.

Water-cooled data centres consume approximately 10% less energy and emit 10% fewer carbon emissions than air-cooled data centres.[29] In 2021, water cooling reduced Google's data centre portfolio carbon footprint by an estimated 300,000 tons of carbon dioxide.[30] On the other hand, Google's global data centre fleet consumed roughly 4.3 billion gallons of water.

Closed-loop cooling is a type of water cooling, whereby cooling fluid is circulated within a closed-loop, and heat is transferred from the IT equipment to the cooling fluid through heat exchangers. The heated cooling fluid is then pumped to an external cooling unit, such as a chiller, where the heat is extracted, and the cooled fluid is returned to the heat exchangers to repeat the cycle. Compared to other cooling systems, such as open loop or air cooling, closed-loop cooling systems are significantly more energy-efficient, as they

23. https://sdgs.un.org/partnerships/net-positive-water-and-carbon-2040
24. https://www.theguardian.com/environment/2021/oct/14/water-positive-pledge-corporations
25. https://www.aboutamazon.com/news/aws/aws-water-positive-by-2030
26. https://www.cisco.com/c/en_au/solutions/data-center-virtualization/what-is-a-data-center.html
27. https://blog.google/outreach-initiatives/sustainability/our-commitment-to-climate-conscious-data-center-cooling/
28. https://www.ibm.com/topics/data-centers
29. https://blog.google/outreach-initiatives/sustainability/our-commitment-to-climate-conscious-data-center-cooling/
30. https://blog.google/outreach-initiatives/sustainability/our-commitment-to-climate-conscious-data-center-cooling/

are able to operate at higher temperatures. This allows for increased free cooling and reduces energy consumption and costs. Closed-loop cooling systems decrease the risk of contamination but are more complex and require more maintenance than air cooling systems.

Examples of the greening of ICT using closed-loop cooling include Lenovo's Neptune-warm-water cooling technologies, which are stated to reduce carbon emissions and total power consumption by up to 40%.[31] Google developed the chiller-less data centre that uses a closed-loop system, while Apple has the closed-loop system referred to as the iCloud data centre. In many regions AWS uses direct evaporative cooling that uses a closed-loop system to cool the IT equipment using air instead of water, and Microsoft has Advanced Energy Recycling that uses a closed-loop system to capture waste heat from IT equipment and use it to heat other parts of the data centre. Facebook has StatePoint Liquid Cooling that uses a closed-loop system to cool IT equipment using a special liquid coolant.[32]

Two examples of closed-loop cooling and best-practice green data centres are CDC Data Centres and GreenSquare DC, both Australian-headquartered providers. ***To find out more, please read the following case studies: CDC Data Centres and Closed-Loop Cooling and GreenSquareDC WA1 – 96MW Green, ethical & responsible AI-ready Data Centre Case Study.***

Recommendation 2: For government, in realising the environmental benefits of a delivered cloud-first strategy, to assess modern, energy-efficient clouds and data centres against the impacts of their own on-premise and legacy systems and allocate a comparative carbon footprint score, acting as an exemplar in accelerated cloud adoption.

Paperless Solutions

The ICT sector is looking beyond buying carbon credits and planting trees as ways to meet carbon goals and looking at their own footprints and ensuring best practice and standards are applied to business operations.

"We're reducing waste by simple measures such as removing rubbish bins from individual workspaces and having common ones. It's creating conscious thought about creating waste and using paper. There's been a review of printers onsite and a reduction in the number of printers. We've moved away from single-use items in our café, especially single-use plastics. We're now investigating future-proofing regarding our campus project – with electric vehicle charging stations and reducing emissions by future-proofing and baking into any projects moving forward sustainability measures through to 2035."

- Professor Tim Boyle, Director, Innovation & Commercialisation, ANSTO

Making one US ton (0.907 metric tonne) of paper requires four trees and emits more than 1.36 metric tonnes of CO2e.[33] Despite astonishing advancements in paperless and e-signature technologies, the use of paper worldwide has actually increased by 40% in the last 40 years.[34] Every 1 million Adobe Sign transactions save 105 million litres of water, 31,000 trees, and the equivalent of taking 2,300 cars off the road for a year—plus reducing costs by more than USD$7.2 million.[35] More than 8 billion transactions electronic and digital signature transactions were processed through Adobe Document Cloud in the past year.[36]

31. https://datacenternews.asia/story/lenovo-launches-fifth-gen-of-neptune-direct-water-cooling
32. https://datacenternews.asia/story/lenovo-launches-fifth-gen-of-neptune-direct-water-cooling
33. https://www.technewsworld.com/story/sustainability-software-part-2-cutting-the-paper-chase-68834.html
34. https://www.survivalrenewableenergy.com/how-going-paperless-can-save-the-environment/
35. https://www.adobe.com/content/dam/cc/en/fast-facts/pdfs/fast-facts.pdf
36. https://www.adobe.com/content/dam/cc/en/fast-facts/pdfs/fast-facts.pdf

Paperless solutions in ICT refers to the implementation of digital technology to replace conventional paper-based methods of communication, storage and information management. Apart from cost savings, increased productivity, enhanced security, improved organisation and remote accessibility, paperless solutions can have a positive impact on the environment by conserving natural resources, minimising greenhouse gas emissions, and reducing waste.

As a resource-intensive product, the production and consumption of paper has a significant negative impact on the environment. Deforestation damages forests that serve as crucial resources for clean air, water, carbon capture, wildlife habitats, climate protection, and human survival.[37] The paper industry is a major producer of air and water pollutants, waste products, and greenhouse gases. It also emits high levels of emissions of toxic chemicals to the air and water.

Water usage in the paper production process is eye watering, with it being one of the largest industrial consumers of water per kilogram of finished product. Waste is also a critical issue, with only 10% of paper consumption retained, while the remaining 90% is discarded as waste.[38] Furthermore, the act of transporting information on paper uses fossil fuels and results in carbon emissions.

As discussed in the Adobe TAFE QLD Case Study, going paperless provides environmental benefits but also time-saving and cost-saving benefits, representing a triple-win opportunity. In that case study, by moving to an e-signature model, the client reduced the time it spent on pre-induction paperwork from roughly 40 minutes to under 10 minutes. Induction registration paperwork reduced from an average of 1 hour to about 30 minutes. Onboarding paperwork was reduced from a 2-week average to just 10 minutes.

Embracing paperless solutions can contribute significantly to several of the United Nation's Sustainable Development Goals, including SDG 9: Industry, Innovation and Infrastructure, which aims to encourage the use of innovative technologies to enhance efficiency and sustainability in the workplace. Another is SDG 12: Responsible Consumption and Production, which seeks to promote sustainable practices in the production and consumption of goods and services. SDG 13: Climate Action and SDG 15: Life on Land has the objective of safeguarding, restoring, and promoting the sustainable use of terrestrial ecosystems, managing forests sustainably, halting and reversing land degradation, preventing biodiversity loss, and combating desertification.

Paperless solutions are ubiquitous in the ICT sector. Not only do they contribute to the greening of the ICT sector itself, but they have delivered extensive greening of organisations and society through the use of ICT. Some examples of paperless solutions in ICT include electronic document management systems (EDMS) that provide a centralised database in which to develop, manage and store documents; electronic signature solutions; cloud storage solutions to store and access documents online; online collaboration to share and collaborate in real time without needing paper copies; and mobile devices to view, access, manage and share documents without the need for paper.

Government's public policy and digital economy-enabling objective of rolling Digital Identity out across the economy from public contexts to corporate is pivotal to the broader move from paper-based means of verifying identity such as printing and photocopying identity documents to secure, interoperable, digital means.

37. https://www.researchgate.net/publication/317815546_Paperless_Society_-_From_Vision_to_Fulfillment
38. https://www.researchgate.net/publication/317815546_Paperless_Society_-_From_Vision_to_Fulfillment

Recommendation 3. For government to measure and report on the environmental benefits that the digitisation of government services and the digital identity framework drives, noting that the move to digital citizen services such as electronic driver's licences, Medicare cards and immunisation information and trusted paperless interactions will drive both efficiency and sustainability.

Paperless technologies play an important role in enabling trusted paperless interactions and reducing the environmental impact associated with documentation. To find out more about what Adobe and its clients have achieved in this area, please see Adobe and RSM Australia: Streamlining client service and promoting sustainability Case Study.

The Move to The Cloud as a Sustainable Solution

Migration to the public cloud provides organisations with more sustainable ways of delivering their digital services. Among the many benefits of cloud computing, its positive impact on the environment is one of the most notable.[39]

While many organisations know that public cloud adoption can assist with scalability, flexibility, and cost savings, there is not as much knowledge surrounding the environmental impact. That is, traditional data centres consume massive amounts of energy and produce significant carbon, while public cloud data centres are often located closer to energy sources, utilise superior hardware setups for efficient energy use, and operate servers at high utilisation rates, reducing the carbon impact on a company's data centre.[40]

High resource utilisation and energy efficiency within modern data centres and moving traditional on-premise workloads to cloud data centres can lower carbon footprints and help large Australian entities holding vast amounts of data to meet their sustainability goals.

Please see AWS Sustainable Cloud Infrastructure Case Study for more information.

Cloud computing providers are optimised for energy efficiency and can use the latest technologies to reduce their energy consumption, such as utilising renewable energy sources like solar or wind power.[41] Moving to the cloud means companies are able to reduce their carbon footprint as they no longer need to maintain their own on-premises servers and data centres, which require a significant amount of energy to run and cool. Cloud providers can achieve economies of scale, reducing the carbon footprint per unit of computing power. Flexibility and scalability are also achievable. As such, companies can avoid wasting energy on underutilised servers and can scale up as needed. Using the cloud can reduce electronic waste as it extends the life of older devices by allowing them to access the latest applications and services without the need for new hardware. It has also allowed employees to work remotely, eliminating commuting and the carbon emissions associated with transportation. It also reduces the need for hardware to be running on-site, as employees can work from home, thereby saving energy and significantly reducing a company's carbon footprint.

UNSW Sydney net zero: putting our research into action case study

39. https://meritum.cloud/the-environmental-impact-of-moving-to-cloud-computing/

40. https://www.missioncloud.com/blog/5-reasons-why-the-cloud-is-environmentally-friendly#:~:text=With%20the%20cloud%2C%20not%20only,for%201.5%25%20of%20all%20electricity

41. https://meritum.cloud/the-environmental-impact-of-moving-to-cloud-computing/

Studies by 451 Research have shown that AWS' Cloud infrastructure is 3.6 times more energy-efficient than the median of US enterprise data centres surveyed and up to five times more energy-efficient than the typical enterprise infrastructure in Europe and Asia Pacific.[42] More than two-thirds of this advantage is attributable to the combination of a more energy-efficient server population and much higher server utilisation. AWS data centres are also more energy-efficient than enterprise sites due to comprehensive efficiency programs that touch every facet of the facility. Additionally, cloud providers are transitioning to renewable energy sources to power their data centres, which reduces their carbon footprint. 451 Research also found that AWS can lower customers' workload carbon footprints by nearly 80% compared to surveyed enterprise data centres, and up to 96% once AWS is powered with 100% renewable energy—a target it is on path to meet by 2025.

In the domestically headquartered market, CDC Data Centres saves up to 5 gigalitres of water – the equivalent of 10% of all water used in the ACT region annually – through the implementation if its industry-leading closed-loop cooling system.

To find out more about CDC Data Centres, please see the CDC Data Centres Case Study.

Further, Australian data centre GreenSquareDC operates on the basis of 5 Pillars of Sustainability:

1. Reduced embodied carbon via reduced overall GFA – arising from higher density yet more energy and water efficient data halls and green building solutions such as green concrete & steel.
2. Alternative, lower emission cooling environments with potential for water positive outcomes and waste heat re-distribution.
3. Alternatives to Fossil Fuel – removal of Diesel fossil fuelled back Up Generators
4. 100% Renewable/Green Certified Power + Onsite Microgrid
5. Artificial Intelligence (AI) = More Efficient Operation.

To learn more about Greensquare DC, please see the GreenSquare DC Case Study

42. https://sustainability.aboutamazon.com/carbon_reduction_aws.pdf

Enterprise Technology and Governments as Agents of Net-Zero

The Role of Enterprise Technology in Helping Organisations Throughout their Supply Chains Reduce their Carbon Footprint

Enterprise Technology (ET) encompasses a vast range of software, hardware and services that organisations employ to assist in streamlining and managing data, communication, activities and processes. ETs are extremely helpful when employed in a whole-of-supply chain context, and more specifically when used to reduce carbon footprint.

Apart from directly using ETs in the reduction of a supply chain's footprint, there are additional spin-off benefits that are positive for business, such as realising efficiencies, lowering resource use, cost savings, risk management and competitive advantage.

"Technology makes it easier to create solutions, to create better solutions and to distribute solutions. [It enhances] your ability to solve problems and to get your solutions adopted."

- Murray Hurps, Director of Entrepreneurship, UTS

The ***benefits*** of using ETs in the organisation can directly relate to the ***reduction of a supply chain's carbon footprint*** through the use of renewable energy technologies. These technologies use solar, hydro, wind, and geo to generate power with lower carbon emissions than traditional coal-fired stations. Some examples in this area include smart grids, smart meters and alternative energy storage methods.

AI, Machine Learning, intelligent business planning and route analysis are all tools that can make processes and supply chains more efficient and thus less wasteful. To learn about how AIIA Member SAP teamed up with beverage company Lion to achieve some of these outcomes, please see SAP and Lion – Optimising Supply Chain Sustainability Case Study.

Apart from the direct environmental benefits of using ETs to lower carbon emissions, additional benefits can also be achieved. For example, by reducing areas where energy wastage occurs, ***cost savings*** can be made. Another benefit of using ETs in the supply chain to reduce the carbon footprint is ***reducing the organisation's exposure to risk.*** That is, significant risk, in the form of legal, compliance and brand, is often connected to carbon emission production. By streamlining and managing the process of carbon reduction, organisations and the whole supply chain are potentially exposed to less risk.

Another benefit for the organisation in using ET to reduce a supply chain's carbon footprint relates to ***advantage over competitors***. Differentiation can occur when organisations and the supply chain in which they are positioned demonstrates commitment to carbon emission reduction. All stakeholders, from investors to consumers, that also hold these same values will naturally be drawn to the organisation.

Empowering customers who wish to make a positive impact and reduce their environmental footprint, including through billing options, is a focus of the Optus Eco program. To find out more, please view the Optus Eco Case Study.

ETs are currently used in tracking and tracing to carbon reduction and removal, the identification of patterns and opportunities to predicting future outcomes. The use of software is one of the most obvious forms of ETs employed in organisations. Supply Chain Management (SCM) Systems – the software used by organisations to manage the movement of goods, services, data and resources right throughout the entire supply chain – is employed with the goal of lowering waste, energy and emissions. An added benefit of using SCM systems in tracking and tracing is compliance with standards and regulations becomes much easier.

Artificial Intelligence (AI) is another ET engaged in data gathering, analysis and understanding. AI can be used to monitor energy usage and emissions, highlight opportunities for lowering carbon, identify high energy use, recognise inefficiencies, flag suppliers with high carbon

emissions, and predict future trends based on current data. Another example of an ET used by organisations in the pursuit of lowering one's carbon footprint across the supply chain is that of the ***digital platform***. These facilitate collaboration and communication amongst stakeholders and across the entire supply chain. Information exchange and project opportunities surrounding carbon reduction are developed, nurtured and coordinated.

Sophisticated analytics and artificial intelligence were leveraged by Accenture, Avanade and Microsoft in their methane emissions detection solution deployed to help Duke Energy achieve its net-zero targets. Please see Accenture, Avanade and Microsoft – Duke Energy Case Study for more information.

Tracking and Tracing Carbon Emissions

In the quest to reduce a supply chain's carbon footprint, ET can be employed as an emissions tracking and tracing tool that affords calculation, transparency, ownership, management, and the highlighting of reduction opportunities. Various tools can be employed based on business requirements, dependent upon the scale or level of data needed, the precision required, and the level of automation sought. Some examples of ET used to track and trace carbon emissions include blockchain, software, the Internet of Things, and artificial intelligence.

One example of IT companies utilising AI and automation to improve efficiency is the work Kyndryl is doing to reduce the emissions of its more than 4000 customers. For more about Kyndryl's work, please see Kyndryl partnering with customers to reduce emissions Case Study.

Blockchain is a well-known ET that can assist in tracking and tracing carbon emissions across the whole of the supply chain. Whilst transparency is a significant benefit of employing blockchain, the main benefit is that it is secure, leaving a trail of credible information that is unable to be interfered with and can be validated. Because tracing is possible, compliance around carbon emissions is enabled and actions can be verified, all of which provides the foundation for a credible carbon market (trading).

Another form of ET is that of *software*. Carbon accounting software is used to track environmental impacts throughout the supply chain. From calculation to documentation and the reporting of carbon emissions, such software can be used to examine carbon release in a certain timeframe, target development, and benchmarking analysis against best practice and industry standards. Various frameworks and greenhouse gas accounting standards – such as ISO, GHG, and industry – can be used as benchmarking tools.

Wireless computing devices – otherwise known as the *Internet of Things (IoT)* – are used to monitor and remotely transmit energy usage and carbon emissions-related data. By providing data in real time, organisations are able to identify where carbon reduction improvement is possible and where irregularities exist. Examples of such devices include sensors and drones that measure, transmit and analyse data in real time.

The use of *artificial intelligence (AI)* is providing significant assistance in carbon footprint reduction due to its ability to analyse mega amounts of data. Together, AI and machine learning can be used to identify trends, data irregularities, data relationships and run simulations of possibilities. Used in future forward trends analysis, forecasting and projections, opportunities and shortfalls can be identified.

Forecasting flood levels and providing advanced warning was one of the achievements recognised by the Cisco Sustainability Challenge, with Madison Group Enterprise receiving a top prize. For more about this Challenge and Cisco's work, please see Cisco Sustainability Challenge Case Study.

Carbon Abatement Technologies

Enterprise Technologies are present in the carbon abatement arena. These technologies are used to remove carbon emissions from the atmosphere, reduce the level of emissions being produced and store carbon in innovative ways. Current ETs achieving this are in the areas of energy efficiency, energy generation, catching and storing emissions, offsetting and removing carbon, and enabling a circular economy. While abatement technologies are being used to lower the supply chain's carbon footprint, they also enable cost reductions and green innovation.

Employed in ***energy efficiency***, ETs decrease the consumption of power in organisations and across the supply chain. Energy savings typically afford cost savings and can be present in such areas as vehicle fleets, buildings, or in the manufacturing process. The ***generation of renewable energy*** is another type of ET, with electricity being generated from renewables, such as solar, hydro, wind and geothermal, thereby reducing the carbon footprint compared to coal-fired stations.

"Achieving net zero is an important element but we actually need to reverse some of the emissions that we've created in the last 100 years. Carbon capture and use (CCU) technologies will play a role and human economic activity will have to become genuinely regenerative."

- Patrick Mooney, Executive Chair, Impact Tech Ventures

Carbon Capture and Storage (CCS), another abatement technology, captures carbon emissions and stores it underground. Technological, biological and geological carbon sequestration offer ways for organisations to lower their carbon footprint by removing and storing carbon from particularly heavy carbon-emitting industries.

The AIIA is recommending that, alongside the new Net Zero Authority and recently announced efforts to turbocharge the hydrogen sector, establish a new Transition authority, establish the National Reconstruction Fund Corporation, and roll out a complementary Industry Growth Program, government establish a new critical infrastructure research partnership.

Such a partnership would have a particular focus on the development of new technologies and capabilities onshore in the climate tech space, including by engagement with the startup and Greentech sectors, to improve energy efficiency and create exportable technology. As Australia continues to transition as an economy to renewables, the management of scarce resources and finite forms of power will require the clever harnessing of technology to enable the transition. The formation of this research partnership, in the model of industry-academic hubs such as the Aerostructures Innovation Research Hub[43], should have as its *raison d'etre* the commercialisation of such technologies and applicability to industrial contexts both at home and abroad.

The role of Research and Development Tax Incentives, the Industry Growth Program and the National Reconstruction Fund

Recommendation 4. For government to establish a commercialisation-focused research partnership aligned to the National Reconstruction Fund priority area of renewables and low emissions technologies. The partnership would focus on the development of new climate technologies and capabilities to improve efficiency, create exportable technology and foster collaboration between business and research institutions.

43. https://www.swinburne.edu.au/research/platforms-initiatives/air-hub/

"There's appetite in climate to get Australian pilots [for climate tech] but it's not going to happen without significant incentives."

- Mick Liubinskas, CEO, Climate Salad

As a price signal, research and development tax incentives (R&DTI) such as the patent box regime and specific tax incentives for green tech and climate tech development will be important to securing the outcomes government needs to see across industry. OECD data reveals that Australia spends less on research and development as a proportion of GDP (1.79 per cent) than the OECD average (2.48 per cent), with spending on R&D having fallen as a percentage of the Australian economy since 2008. [44] The path to net-zero that was released under the Morrison Government in 2021 estimated that 15% of reductions would result from innovative new technologies. In the 2023-24 Budget, the Albanese Government announced a new Net-Zero Authority to be housed within the Department of Prime Minister and Cabinet. [45] The third stated object of the Authority is to 'help investors and companies to engage with net zero transformation opportunities.' The AIIA is recommending that the Authority have a focus on new innovative exportable technologies and include consideration of the R&DTI landscape within which technology companies and those purchasing their products operate.

The energy transition is an opportunity for the government to support the development of innovative, exportable technologies that will help drive the energy transition. This will not just have an impact domestically, but internationally via export and collaboration with trusted partners, including through the Quad and AUKUS.

The inclusion of clean energy generation and storage technologies as one of the simplified seven categories that form the organising principle for the 2023-updated **List of Critical Technologies in the National Interest** is positive government leadership. Example applications within this category include:

- Emissions reduction technologies
- Advanced energy storage
- Directed-energy technologies, which can transfer energy between 2 points without wires
- Large-scale renewable energy generation
- Low-emission alternative fuels, including biofuels
- Small-scale distributed energy harvesting, in which devices or systems power themselves by harvesting energy from the surrounding area [46]

Through the Department of Industry, Science and Resources (DISR) the government has an opportunity to provide accelerator funding for early-stage green tech and climate tech startups, especially given the introduction of the Industry Growth Program to create a pipeline of National Reconstruction Fund (NRF)-ready SMEs. Further, priority access to the latter two Programs for such companies that relate to the priority area of 'renewables and low emissions technologies' for both the Fund and the Program. Finally, government setting regulatory standards to encourage the adoption of green technologies will be pivotal in creating the right conditions for industry take-up.

Recommendation 5. For the Government, under the purview of the new Net Zero Authority, to use the energy transition from heavy carbon emitters such as coal and gas to renewables as an opportunity to support the development of new innovative exportable technologies that will drive this transition not just in Australia but internationally to support the transition of the nation's largest emitting sectors to reduce their carbon intensity, including through:

a. Creating a specific and targeted tax incentive through a green R&D tax incentive;

44. https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm
45. https://www.pmc.gov.au/news/new-national-net-zero-authority
46. https://www.industry.gov.au/publications/list-critical-technologies-national-interest/clean-energy-generation-and-storage-technologies

b. **Providing funding for research and development (R&D) in clean energy technologies to provide a pipeline for the venture capital work of the CEFC's Clean Energy Innovation Fund;**
c. **Allocate funding from existing programs from the Department of Industry, Science and Resources specifically for green tech and climate tech start-ups;**
d. **Making access to, and support from, the Industry Growth Program and National Reconstruction Fund for start-ups in the 'renewables and low emissions technologies' area a first priority of these initiatives; and**
e. **Reviewing and developing regulatory standards to encourage the adoption of green technologies.**

Government's role in galvanising the decarbonisation of the economy

The decarbonisation of the economy involves moving away from a carbon-based economy to one that is powered by clean, renewable energy sources. This is necessary to reduce greenhouse gas emissions and mitigate the impacts of climate change. Actions to achieve decarbonisation include reducing energy consumption, shifting to renewable energy sources, electrifying transportation, developing low-carbon technologies, and promoting a circular economy. Achieving decarbonisation requires collaboration and coordination among governments, businesses, and communities.

By partnering with the Good Food Institute, AIIA Member Accenture enabled the organisation to take a "moonshot" approach to effecting the transition to alternative proteins as part of its non-profit mission to finding plant- and cell-based alternatives to animal products. For more, please see Accenture and The Good Food Institute Case Study.

Governments can also accelerate the development of green technology solutions by making relevant data more accessible to emerging green technology companies and academia. With the announcement of the new Net Zero Authority in May 2023, focus on transitioning carbon-intensive industries and finding new solutions within transition-challenged sectors such as energy, transport and resources has been galvanised. Government is a significant holder of data and consortia of governments, industry bodies and academia can together harness the power of this data through analytics. The C4NET (Centre for New Energy Technologies) project in Victoria is an example of this approach, whereby depersonalised energy consumption data is made available to emerging companies to develop and model new solutions. C4NET is a collaboration established by the Victorian Government in 2017 between Swinburne University, Monash University, RMIT University, Federation University, Deakin University and the University of Melbourne, AusNet Services and Powercor.[47]

Projects under C4NET have used data analytics to investigate energy usage, customer profiling, rooftop solar take-up and forecast take-up, and the electricity consumption behaviour of households with batteries and investigating its impact on the distribution network. A similar approach with a focus on the sectors of energy, transport and resources at the federal level should be taken by government. Examples of datasets that may be relevant include water consumption, energy supply, energy efficiency, climate data, agricultural productivity, freight, transport and minerals data.

Recommendation 6. That government work with industry and academia to activate the data it holds by establishing a collaborative body similar to C4NET in Victoria for the modelling and testing of new solutions, and analysing transition progress, in high-emission or transition-challenged sectors such as energy, transport and resources.

47. https://c4net.com.au/

Carbon Offsetting and Circular Economy Considerations

A supply chain's carbon footprint can also be lowered through ***carbon offsetting***. With the aim of decreasing an organisation's net carbon emissions, enterprises invest in carbon reduction or removal projects – thereby offsetting their own emissions. These projects can be in the areas of renewable energy generation, energy efficiency, carbon capture and storage, afforestation and reforestation.

Circular economy technologies are another type of ET that aims to lower the supply chain's carbon footprint. By using technologies to reduce, reuse and recycle, less raw material is mined, used and processed – thereby potentially lowering carbon emissions. Investment in technologies can lead to further development of innovative solutions in this area.

Power purchase agreements with renewable energy generators can significantly offset carbon emissions by technology companies. AIIA Member Fujitsu Australia in April 2022 entered into a Power Purchase Agreement with renewable energy sourced from CWP Renewables' Sapphire Wind Farm, the largest operational wind farm in New South Wales. This 10-year agreement is projected to offset around 30,000 tonnes of Fujitsu Australia's carbon emissions each year. For more, see Fujitsu Australia Limited Power Purchasing Agreement (PPA) Case Study

As well as CO2 Offset Services for Lenovo customers, AIIA Member Lenovo is a leader in circular economy principles, increasing the use of recycled and recyclable materials in packaging, including the use of bio-based materials and reduced-size packaging. For more information, please see Lenovo: Envisioning Net-Zero by 2050 Case Study.

Reporting, Accountability and Transparency

The employment of Enterprise Technologies by an organisation to reduce the supply chain's carbon footprint is, while an important component, only the first part of the equation. Actions, results and outcomes must be reported to all stakeholders, with quality reporting, accountability and transparency having the power to boost investment, markets and brand. Transparency in the report process builds trust amongst stakeholders, the supply chain, and the actions to combat climate change being taken.

The tech sector in Australia is coming under increasing scrutiny over the actions it is taking to lower carbon emissions and its performance outcomes, with regulators increasingly seeking compliance. Accurate and quality reporting is fundamental to satisfying these developments.

In Australia, carbon reporting is guided by a number of ***frameworks and standards*** – all of which require standardised carbon reporting in order to present and compare performance against standards and with peers. For example, the mandatory *National Greenhouse and Energy Reporting (NGER) scheme (established by the NGER Act 2007), The Climate Active Carbon Neutral Standard (voluntary), the Global Reporting Initiative (GRI 305: Emissions), The CDP, and the Task Force on Climate-related Financial Disclosures (TCFD)* are frameworks and recommendations used for carbon reporting.

Deloitte partnering with Sydney Local Health District – Digitising Sustainability Reporting with Net Zero Cloud Case Study

Carbon reporting should be ***accurate*** and ***verifiable*** by third-party independent actors, underpinned by robust data, credible sources, and quality collection methods. The National Association of Testing Authorities (NATA) is a national authority that accredits organisations with the ability to perform testing and inspection activities for their products and services.

Reporting the organisation's carbon reduction targets, strategies and progress sits under ***organisational accountability***. Stakeholders are increasingly expecting their purchasing and investing power to be environmentally positive, and that organisations and supply chains are committed to the goals of the Paris Agreement. Apart from carbon reduction targets, the organisation should be transparent about the

ways they intend on reducing carbon, their performance, risk, and areas where there is potential to improve.

The Australian technology sector has extensive expert knowledge in Enterprise Technology that underpins carbon reduction efforts. The opportunities for collaboration with other sectors and across a diverse range of stakeholders is favourable to ***technological innovation*** in searching for ways to reduce a supply chain's carbon footprint.

A powerful example of analytics and cloud technology underpinning carbon reduction efforts by concert-goers in the context of a major global band's world tour, please see SAP and Coldplay's *Music of the Spheres* Tour Case Study.

For more on enterprise technology assisting customers to reduce their environmental impact, please see Telstra's Case Study Helping Customers Go Green – Enabling Positive Climate Action Through Digital Tech.

Governance Aspects and Board & Director Responsibility for ESG

ESG (Environmental, Social, and Governance) as criteria used to evaluate the sustainability and ethical impact of an investment or business decision is one of the most important matters faced by organisations and supply chains in today's business environment. Carbon footprint reduction is arguably the greatest ESG issue. A robust governance framework will assist organisations as they navigate these issues.

More effective risk management, performance and bottom-line results are achievable when ESG considerations are integrated into the organisational decision-making process, as opposed to tacking them on at the end.

"We need people and companies to change behaviour. People often think they don't count or add up to enough, but every person is not just a voter but also a consumer, an employee and an investor."
- Mick Liubinskas, CEO, Climate Salad

The governance aspects of ESG speak to organisational policies, procedures and structures that are used to manage environmental, social and governance risks and opportunities, specifically in this case carbon reduction. In terms of governance aspects, the ***board provides oversight***, being responsible for ensuring that ESG performance, in particular the carbon footprint of the organisation and the entire supply chain, is aligned with the organisation's strategy and goals.

Other governance aspects include the creation of ***policies and procedures*** for ESG risk management, the ***measuring*** of ESG performance in the form of KPIs to assist in carbon reporting, the identification and management of ***ESG risks*** to assist in carbon footprint reduction, and ***engagement*** with relevant stakeholders to ascertain expectations and concerns surrounding ESG. The accuracy, transparency and timeliness of ***reporting*** ESG issues is a critical governance matter. ***Performance evaluations*** of board and executives should incorporate ESG performance.

Since 2008, Infosys has implemented changes to processes and operations on the basis of its ESG focus, across Tech for Good initiatives, smart data and monitoring across Infosys campuses, carbon reduction programs, diverse hiring practices and privacy-by-design. For more information please see Infosys ESG Journey Case Study.

The appointment of board members should be based on expertise surrounding pertinent ESG issues. Roles should involve policy and procedure development to guide ESG oversight, periodic reporting of progress should be made against ESG risks and opportunities, periodic updating of ESG policies and procedures to keep abreast of risks and opportunities, and board members should partake in stakeholder engagement to gauge expectations and requirements.

Recommendation 7. For government to support industry in referring to clear metrics and reporting standards that enable a successful economic transition, and promote clear data standards to give industry a clear mechanism to report and measure against.

The duty to act in the best interests of an organisation is not synonymous with 'profit at all costs' or simple dollar proxies such as share price. Rather, considering the impacts of their organisations, both positive and negative, and deploying effective offsets to the latter, is the core business of directors.

It should be noted that corporate governance was originally modelled upon parliamentary models of public governance, family ownership and hereditary succession planning, all of which have been corporatised. An operational emphasis on financial indicators became dominant in line with that process of corporatisation. However, in the twenty-first century, both publicly listed and not-for-profit boards and increasingly grappling with non-financial indicators to inform decisions and deliver dutiful corporate governance.

Stakeholder capitalism theory,[48] the concept that a board has responsibilities to groups beyond its stakeholders, is gaining traction, whilst its contemporaneous rival, neo-liberalism, is still ideologically dominant. The latter theory still holds that stakeholders and the environment are not legitimate interests to be considered by a for-profit business due to their character as externalities, with some considering such a character antithetical to the profit motivation and purpose of a corporation.

The convergence of the 'peak oil' era and the increasing effects of climate change has seen growing trends of rights-based, harms-based and risk-based regulation, such as Modern Slavery, Data Privacy, cyber security, Artificial Intelligence regulation, data sovereignty, and environmental and climate risk ratings and forced disclosures. Industry is also seeing the advent of social enterprise and B-Corp models, and other market developments indicating shareholder interest in paying a premium for ethically-driven and positively impactful investments, based on evidence and demonstrated in data and information, and accountable decisions that come from a non-financial values driven, harm and human risk aware leadership and strategy, informed by and aligned to the breadth of the UN Sustainable Development Goals.

Environmental accountability must be seen as a core governance matter, over and above a matter of accounting, profits and dollar proxies, taking what have until now been seen as 'externalities' to the heart of each organisation's core business.

Government's role in enabling the use of technology for sustainability: *The policy settings in place to encourage investment into green startups and innovative solutions as a permissive and de-risking environment.*

The Australian government has an exceptional ability to influence and support the use of Enterprise Technology employed in carbon footprint reduction. Policy settings and programs that the government can deliver to encourage investment into green startups and innovative solutions include tax incentives, government grants, investment, regulatory support, public procurement and industry partnerships, to name a few.

Whether it is tax breaks or tax credits, the Australian government can provide ***tax incentives*** to encourage investment into green startups and solutions. The R&D incentive

48. https://www.weforum.org/agenda/2021/01/klaus-schwab-on-what-is-stakeholder-capitalism-history-relevance/

should fully recognise novel software and hardware development as eligible activities and a premium rate could be considered for developments that accelerate achievement of ESG goals.

Another method to encourage investment includes ***government grants***. Such grants can relate to R&D, commercialisation, and funding for pilot projects and startups. For example, commercialisation and SME growth support grants via the recently announced $392 million Industry Growth Program should include in their assessment criteria not only the commercial potential of the specific invention, but also its potential to have a broader impact on achievement of ESG goals. Relevant Government investment agencies including the Clean Energy Finance Corporation (CEFC) and Australian Renewable Energy Agency (ARENA) could have similar criteria applied.

"In Australia the ESG shift was led by consumers, for example through solar panel deployment (now over 30% of households, the highest penetration in the world). Industry has responded to shifts in consumer expectations and in the last 2-3 years government and policy frameworks have started to catch up. There is much greater transparency and cohesion of effort now and funding agencies like the Clean Energy Finance Corporation are playing an important role in backing climate-friendly projects."

- Patrick Mooney, Founder, ImpactTech Ventures

The government can also encourage investment in green startups and solutions via ***regulation***. It can focus on areas where such enterprises hit barriers to entry. For example, this might include certain exemptions or even accelerating the approvals process for specific projects. Additionally, by having tailored regulation surrounding carbon reduction, such as in the form of ***standards and targets***, investment and adoption in green startups and reduction solution technologies is sought-after and boosted.

Another area where government can drive investment in such enterprises is through ***partnering*** with stakeholders directly involved in R&D and commercialisation. Partnering with industry associations that possess the commercial expertise, direct industry connections and technical knowledge leverages existing resources and adds to the credibility that stakeholders are seeking. Government can take advantage of the significant expertise, knowledge and resources that already exist within industry. This might take the form of funding partnerships or providing support to encourage uptake of such technologies. These partnerships can also be international in nature, such as R&D collaborations, where knowledge and resource sharing promote innovation and investment.

Government can also drive investment in green technologies and solutions via the use of ***direct innovation and procurement***-related initiatives. These may include innovation challenges focussed on the issues that government agencies face in transitioning to net zero, particularly in high emissions sectors such as transport and power generation. They can also include purchasing targets and commercial scale proof of concept projects.

Recommendation 8: For government to be an exemplar and lead in reporting on the carbon impacts of its own procurements, including ICT. This will require government agencies to invest in the ability to capture and report carbon footprint across its business. Agencies should also report annually and be measured against set KPIs in reducing their carbon footprints.

For an example of smart, sustainable procurement enabled by AIIA member SAP, please see the SAP and Iberdrola – How can smarter, more sustainable procurement processes help achieve carbon neutrality? Case Study.

Driving the Green Economy of the Future

Net-zero by 2050: How Australia became a global leader in decarbonisation through 4th and 5th Industrial Revolution technologies: *A future retrospective*

In 2050, Australia stands as a global leader in decarbonisation, thanks to the successful integration of emerging technologies from the 4th and 5th Industrial Revolution into its economy, industries, and workforce. The country has achieved its goal of net-zero emissions, reducing its carbon footprint by 100% from 2005 levels, and has inspired other nations to follow suit.

The ***Internet of Things (IoT)*** *has been instrumental in this transformation. IoT sensors have been deployed across various industries, allowing for real-time monitoring of energy consumption and emissions. For instance, in agriculture, IoT sensors have enabled farmers to optimize crop yields and minimize waste, while also reducing emissions from fertilizer use and livestock. This has resulted in a 45% reduction in greenhouse gas emissions in the agriculture sector since 2005.*

Artificial Intelligence (AI) *has also played a critical role in the decarbonisation of Australia's economy. AI-powered energy management systems have helped businesses and households reduce their energy consumption by up to 30%, while also enabling better integration of renewable energy sources such as wind and solar into the grid. This has resulted in a 65% reduction in emissions from electricity generation since 2005.*

Robotics and automation *have transformed the manufacturing industry, enabling more efficient and sustainable production processes. For instance, 3D printing has revolutionized the production of complex parts, reducing waste and energy consumption. This has led to a 30% reduction in emissions from manufacturing since 2005.*

Green technologies such as hydrogen fuel cells and advanced batteries have also played a critical role in decarbonising the transport sector. Electric vehicles powered by these green technologies now dominate Australia's roads, with petrol and diesel vehicles phased out. This has resulted in an 80% reduction in emissions from transport since 2005.

"The adaption of nuclear technologies by convergence with other systems is really exciting. As we move to a hydrogen energy economy, nuclear technologies are some of the cleanest ways of making hydrogen at scale."

- Professor Tim Boyle, Director, Innovation & Commercialisation, ANSTO

The successful integration of these emerging technologies into Australia's economy and industries has also created new jobs and opportunities for the workforce. Skills in data analysis, AI programming, and robotics engineering are now in high demand, and Australia has invested heavily in vocational education and training to develop these skills.

Overall, the successful decarbonisation of Australia's economy through the integration of emerging technologies from the 4th Industrial Revolution has been a monumental achievement, with significant benefits for the environment, economy, and society. The country is now poised to continue leading the way towards a sustainable and prosperous future.

Industry 4.0, Industry 5.0 and the future of work: green skills as part of every role

Industry 4.0, also known as the fourth industrial revolution, is a rapidly evolving trend that is changing the way we live, work, and do business. It is characterised by the convergence of technologies such as artificial intelligence, the internet of things, and big data analytics, and has the potential to transform manufacturing, energy, and other sectors, leading to greater efficiency, productivity, and sustainability. This section argues that the adoption of Industry 4.0 technologies is critical to the Australian economy's transition to a low carbon emissions future, and that the development of new skills and the upskilling of the workforce will be essential to ensure the successful implementation of these technologies.

Industry 4.0 has the potential to transform the way we work and the skills that will be required in the future. The adoption of emerging technologies will lead to the automation of many routine tasks and the creation of new jobs in areas such as data analytics, cybersecurity, and artificial intelligence. According to a report by the Australian Computer Society, the adoption of Industry 4.0 technologies could lead to the creation of up to 2.2 million new jobs in Australia by 2030, with the majority of these jobs requiring digital skills and expertise.

Industry 5.0 is a new paradigm that incorporates Robotics and Artificial Intelligence and their effect on enhancing workplace processes. The radical transformation underway as AI becomes more deeply deployed in agriculture, healthcare, food processing, manufacturing, geographic exploration, and corporate business has ESG ramifications.

Robots have a role to play in combating climate change, significantly reducing carbon intensity.[49] The most direct way that robotics achieves this is through the increase in economic efficiency of producing products and services, which increases the resources available for combatting climate change.[50]

The installation of responsible robotic machinery, including robots powered by renewable sources of energy, can reduce the level of emissions generated by industry. Robots also assist in the more targeted, efficient and reduced use of chemicals in agriculture, the installation of photovoltaic (solar) panels,[51] and the planting of trees.

Drones play a role in capturing high-resolution, infrared, thermal images of solar and wind farms, and the remote inspections of wind turbines and solar plants.[52] Robots are also helping to recycle and decrease manufacturing waste.

"Robots have skills such as strength, precision and sensing often surpassing those of humans. Combining the physical endurance of the robots with the cognitive flexibility of humans in a collaborative fashion is advantageous in different applications that enable sustainability and support environmental aspects."[53]

As explained by Harvard University, "Mitigating climate disasters requires fast response in unpredictable and unstable environments. Robotic systems can assist in responding to the predicted increase in floods by rescuing victims and assisting with post-flood recovery. Similar roles for robots can apply to wildfires. In addition, robots can help with restoring biological impacts of climate change, for example by planting trees and killing invasive species."[54]

Recommendation 9: That the Government in its design and rollout of the National Robotics Strategy target funding, grants and procurement to applications of robotics in responding to climate disasters, achieving environmental efficiencies in agriculture, managing solar and wind energy applications and planting trees.

49. https://www.sciencedirect.com/science/article/abs/pii/S0160791X22001750
50. https://projects.iq.harvard.edu/climatechangeworkshop/home
51. https://www.bimplus.co.uk/sarcos-robot-successfully-installs-solar-panels/#:~:text=An%20American%20robotics%20company%2C%20Sarcos,vehicle%20to%20install%20the%20panels.
52. https://www.futurebridge.com/industry/perspectives-energy/how-are-drones-and-robots-empowering-renewable-energy/
53. https://www.frontiersin.org/research-topics/45405/robotic-applications-for-a-sustainable-future
54. https://www.frontiersin.org/research-topics/45405/robotic-applications-for-a-sustainable-future

The transition to Industry 4.0 and 5.0 will require significant investments in education and training to ensure that the workforce has the necessary skills to operate and maintain these technologies. According to a report by Deloitte Access Economics, there is a growing skills gap in Australia, with many workers lacking the necessary skills to support the transition to Industry 4.0 and 5.0. The report suggests that new skills will be required in areas such as data analytics, automation, and cybersecurity, and that a concerted effort will be needed to ensure that the workforce is adequately trained to meet these new demands.

Artificial Intelligence and Large Language Models (LLM)

While robotics and Artificial Intelligence have a role to play in reducing emissions, the environmental effects of the latter require thoughtful consideration by industry and government. AI should not be assessed along binary lines; instead its energy intensiveness and great technological potential are both line-items that factor into the AI balance sheet.

Some of the examples of AI's potential for reducing emissions include:

- Smart grid design[55]
- The development of low-emission infrastructure[56]
- In the case of self-driving vehicles, identifying the most optimal route to reduce emissions by up to 50%[57]
- Producing higher agricultural yields with the efficient use of AI in agriculture;
- Precise monitoring of compliance with emission reduction targets
- Analysis and monitoring of climate patterns[58]
- Predictive AI to anticipate future climate emission data and the evolution of weather systems, including in relation to bushfires and floods, and the effect of particular scenarios on such future emissions or disaster scenarios.[59]

Recommendation 10: For the Government, as part of the National Emergency Management Agency's and Australian Government Crisis Coordination Centre's operations, incorporate world-leading applications of AI, including extending applications of AI to disaster management e.g. preparedness and recovery phases.

However, the energy intensiveness of AI is an important part of the picture.

Even before the advent of 2022-type Large Learning Models (LLMs) such as ChatGPT and Bard, in 2019 researchers associated with the University of Massachusetts Amherst conducted an analysis of Natural Language Processing (NLP) training models along environmental lines. Their goal was to estimate, in kilowatts, the energy cost associated with training such models. It was found that the carbon footprint resulting from training just one of these models is equivalent to approximately 300,000 kilograms of CO2 emissions. In layperson's terms, this is equal to the emissions associated with 125 round-trip flights between New York and Beijing.[60]

The water impacts of LLMs must also be considered:

A recent study by researchers at the University of California, Riverside, revealed the significant water footprint of AI models like ChatGPT-3 and 4. … approximately 700,000 litres of freshwater [were used] during GPT-3's training in … data centres – that's equivalent to the amount of water needed to produce 370 BMW cars or 320 Tesla vehicles. This is primarily a result of

55. https://www.forbes.com/sites/cognitiveworld/2019/03/20/the-role-of-smart-grids-and-ai-in-the-race-to-zero-emissions/?sh=5e3e47f31c8e
56. https://web-assets.bcg.com/ff/d7/90b70d9f405fa2b67c8498ed39f3/ai-for-the-planet-bcg-report-july-2022.pdf
57. https://www.cfr.org/blog/artificial-intelligences-environmental-costs-and-promise
58. https://www.makeuseof.com/ways-ai-help-fight-climate-change/#:~:text=For%20example%2C%20an%20AI%20tool,the%20event%20of%20a%20disaster.
59. https://www.makeuseof.com/ways-ai-help-fight-climate-change/#:~:text=For%20example%2C%20an%20AI%20tool,the%20event%20of%20a%20disaster.
60. https://www.nature.com/articles/s42256-020-0219-9

the training process, in which large amounts of energy are used and converted into heat, requiring a staggering quantity of freshwater to keep temperatures under control and cool down machinery. Further, the model also consumes a significant amount of water in the inference process, which occurs when ChatGPT is used for tasks like answering questions or generating text. For a simple conversation of 20-50 questions, the water consumed is equivalent to a 500ml bottle, making the total water footprint for inference substantial considering its billions of users.[61]

The exact energy intensiveness of LLMs such as ChatGPT is an inexact quantity, depending on the energy usage of the servers and data centres that run it,[62] as well as the heat-intensive processes with which it was trained.[63] One leading Danish data scientist, Kasper Groes Albin Ludvigsen, estimated that in January 2023, ChatGPT's electricity consumption in January 2023 is estimated to be between 1,168,200 KWh and 23,364,000 KWh.[64] Obtaining a clearer picture of these environmental impacts and a clear plan for achieving efficiencies within this slice of the tech sector should be a priority for the tech sector and government.

Recommendation 11. For government and industry to partner to study the sustainability impacts of emerging technologies including Large Language Models that drive generative AI technologies, quantum technology and the significant compute required for these technologies and ensure sustainability goals are incorporated into the execution of National Strategies in quantum technology and artificial intelligence.

Low Carbon Emissions Economy and Industry 4.0 and 5.0

The adoption of Industry 4.0 and 5.0 technologies is critical to the Australian economy's transition to a low carbon emissions future. These technologies can help to reduce energy consumption, improve resource efficiency, and increase the use of renewable energy sources. For example, the implementation of smart grids and energy management systems can help to reduce energy waste and optimise the use of renewable energy sources such as solar and wind power.

Industry 4.0 and 5.0 technologies can also help to reduce the carbon footprint of manufacturing and other industries. The implementation of advanced manufacturing technologies such as 3D printing and robotics can help to reduce waste and improve efficiency, leading to lower emissions and reduced resource consumption. In addition, the use of data analytics can help to identify opportunities for energy and resource savings, leading to further reductions in emissions and improved sustainability.

61. https://earth.org/environmental-impact-chatgpt/
62. https://www.bloomberg.com/news/articles/2023-03-09/how-much-energy-do-ai-and-chatgpt-use-no-one-knows-for-sure#xj4y7vzkg
63. https://towardsdatascience.com/the-carbon-footprint-of-chatgpt-66932314627d
64. https://towardsdatascience.com/chatgpts-electricity-consumption-7873483feac4

Skills Gaps and a Low Carbon Emissions Economy

"The largest lever government has that can really impact an industry like this is the availability of talent. They hold most of the levers that can redirect what people study and who is led into the industry. Both are difficult levers to pull, but there's a lot of research to support that. If you allow a lot of immigration and skilled people, or drive an increase in the availability of education in these areas, then you can make a really meaningful difference to these industries."

- Murray Hurps, Director of Entrepreneurship, UTS

To support the transition to a low carbon emissions economy, new skills will be required in areas such as renewable energy, energy efficiency, and sustainable manufacturing. According to a report by the International Renewable Energy Agency, the renewable energy sector alone is expected to create up to 42 million jobs worldwide by 2050. In addition, the implementation of sustainable manufacturing practices will require workers with skills in areas such as circular economy principles and green supply chain management. Making this transition to a renewable economy in a country in which emissions-intensive sectors have had a significant historical and current role will be under the purview of the new Net Zero Authority.

Recommendation 12. For government to enhance labour mobility for workers with green skills in renewable energy, climate tech, waste management, disaster resilience and climate adaptation in its priority migration settings and fast-tracking, leveraging alliances and bilateral agreements with Asia-Pacific neighbours such as the Singapore-Australia Green Economy Agreement (Skills and Capabilities for Green Growth area for cooperation).[65]

AIIA Member Amazon is leading in the corporate purchase of renewable energy, and is on a path to powering its operations with 100% renewable energy five years ahead of schedule by 2025, having attained 85% of renewable energy across its business in 2021. For more about Amazon and renewable energy, please see Amazon and Renewable Energy Case Study.

Closing the skills gap will require a concerted effort from government, industry, and education providers. This could include initiatives such as the development of new training programs, apprenticeships, and internships, as well as investments in research and development to support the development of emerging technologies and practices.

In summary, the adoption of Industry 4.0 technologies is critical to the Australian economy's transition to a low carbon emissions future. However, the successful implementation of these technologies will require the development of new skills and the upskilling of existing workers to meet the demands of the future workforce. The Australian Government has recognised the importance of this and has already taken steps to address the skills gap through initiatives such as the Industry 4.0 Higher Apprenticeships Program and the Technology Investment Roadmap.

65. https://www.dfat.gov.au/countries-and-regions/singapore-australia-green-economy-agreement-annexes/annex-b-51-australia-singapore-green-skills-roundtable

Furthermore, the transition to a low carbon economy is an opportunity to create new jobs and industries. The renewable energy sector has already shown significant job growth in Australia, with a 28% increase in employment between 2017 and 2019. By investing in Industry 4.0 and the low carbon economy, Australia can position itself as a leader in the global market and create sustainable economic growth for the future.

Overall, the adoption of Industry 4.0 technologies and the transition to a low carbon economy represent significant opportunities for the Australian economy. By addressing the skills gap and investing in emerging technologies and industries, Australia can not only reduce its carbon emissions but also create new jobs and economic growth. It is important for policymakers, businesses, and individuals to recognise the importance of these changes and take action to support the transition to a low-carbon future.

The AIIA is recommending that the Department of Employment and Workplace Relations embed ESG into the Australian Digital Capability Framework (ADCF)[66] as a seventh focus area to enable the development of green microcredentials referring to the ADCF as part of the National Microcredentials Framework.[67] Further, the AIIA is calling for ESG skills to become a mandate of the Digital and Tech Skills Compact[68] leading out of the Jobs and Skills Summit, with ESG components of cadetships, digital apprenticeships and work-integrated learning placements prioritised.

Recommendation 13. That the Government, through the Department of Employment and Workplace Relations, embed ESG into the Australian Digital Capability Framework (ADCF) as a seventh focus area to enable the development of green microcredentials referring to the ADCF as part of the National Microcredentials Framework and make ESG skills a mandate of the Digital and Tech Skills Compact leading out of the Jobs and Skills Summit, with ESG components of cadetships, digital apprenticeships and work-integrated learning placements prioritised.

Recommendation 14. For government to work with industry to undertake course and skills mapping and to fund scholarships to incentivise and enable students to complete undergraduate and VET courses encompassing renewable energy, waste management, climate tech, and disaster resilience to support the green economy jobs of the future. Through the Net Zero Authority, these scholarships should have a focus on youth and career-changers in areas with a historical economic reliance on emissions-intensive sectors.

66. https://www.dewr.gov.au/skills-and-training/resources/australian-digital-capability-framework
67. https://www.education.gov.au/higher-education-publications/resources/national-microcredentials-framework
68. https://www.minister.industry.gov.au/ministers/husic/media-releases/digital-and-tech-skills-compact

The Future of a Digital Economy and The Vital Nature of Sustainability for Economic Growth

The digital economy and sustainability are closely linked for economic growth. Digital technologies can provide innovative solutions to sustainability challenges, such as reducing energy consumption and improving resource efficiency. Ways in which the digital economy can contribute to sustainability include enabling energy efficiency, supporting renewable energy, improving resource efficiency, facilitating circular economy, and supporting sustainable consumption and production. Addressing sustainability challenges is important for the long-term viability of the digital economy. By promoting sustainability, a more resilient and prosperous digital economy can be created that benefits everyone.

Working towards a circular economy, nature-based solutions and natural capital, recycling and waste reform

The Australian economy is facing significant challenges in reducing its carbon emissions and transitioning to a low-carbon economy. With the increasing impact of climate change, there is an urgent need for transformative change in the way we produce and consume goods and services. This section argues that the circular economy, nature-based solutions, natural capital, and waste reform are critical to reducing carbon emissions and creating a sustainable future for Australia's economy.

For a holistic look of the progress of one AIIA member in reducing operational emissions across the board, please see the Optus' progress on environmental sustainability Case Study.

Circular Economy

The circular economy is an economic model that prioritises reducing, reusing, and recycling materials, products, and waste streams. This approach creates a closed-loop system that minimises the use of finite resources and reduces the carbon footprint of production and consumption. The circular economy provides significant opportunities for the Australian economy to reduce its carbon emissions and enhance its competitiveness in global markets.

There are strong examples of the advancement of a circular economy in the innovative practices employed by Original Equipment Manufacturers (OEMs) within the AIIA's membership community. To find out more, please see CASE STUDY: Hewlett-Packard's Advancement of Circularity, CASE STUDY: Epson reducing the environmental impact of its customers and CASE STUDY: Epson's Closed Resource Loop Initiatives.

According to a report by the Ellen MacArthur Foundation, the adoption of circular economy principles in Australia could reduce greenhouse gas emissions by up to 27% by 2050. The report also found that the adoption of circular economy principles could lead to economic benefits, including the creation of 80,000 new jobs and the generation of AUD $26 billion in annual economic benefits.

As an example of technology aiding circular economy outcomes, AIIA Member SAP's GreenToken innovation can track the quantum of recycled content used in packaging. For more information, please see SAP's Recycled Plastic Tracking for DIC Japan Case Study.

Nature-Based Solutions

Nature-based solutions refer to the use of natural systems and processes to address social, economic, and environmental challenges. This approach recognises the critical role of nature in providing ecosystem services that underpin economic and social development. Nature-based solutions can help to reduce carbon emissions, enhance biodiversity, and improve the resilience of natural systems.

The adoption of nature-based solutions can lead to significant economic benefits for Australia, including increased productivity, improved public health, and reduced environmental risks. According to a report by Deloitte Access Economics, investing in nature-based solutions could generate up to AUD $12 billion in economic benefits for Australia by 2050.

Examples of nature-based solutions in Australia include the restoration of degraded landscapes, the use of green infrastructure in urban areas, and the protection of biodiversity hotspots. These measures can help to sequester carbon, improve soil health, enhance biodiversity, and reduce the impact of natural disasters.

Natural Capital

"We've cared about money for thousands of years and have millions of accountants around the world. We need people caring and valuing the environment that keeps us alive in terms of flora, fungi, fauna, microbes, air, water, kelps, coral, everything and caring about that, understanding it, loving it, nurturing it, looking after it. That's the fourth kind and we need all kinds of technology for that. We have robots out of the Great Barrier Reef developing ways to plant new coral and we need to be able to do that and grow our natural assets much better."

- Mick Liubinskas, CEO, Climate Salad

Natural capital refers to the stocks of natural resources, such as forests, oceans, and biodiversity, which provide ecosystem services and support human well-being. The valuation of natural capital can help to ensure that the economic value of nature is recognised and integrated into decision-making processes.

Accenture and the Australian Institute of Marine Science Case Study

The sustainable management of natural capital is critical to reducing carbon emissions and ensuring the long-term viability of the Australian economy. According to a report by the Australian National University, the value of natural capital in Australia is estimated to be between AUD 443 billion and AUD 6.3 trillion. The report also found that the degradation of natural capital could result in significant economic costs, including the loss of ecosystem services, reduced agricultural productivity, and increased vulnerability to natural disasters. Examples of natural capital management in Australia include the protection of forests and wetlands, the restoration of degraded landscapes, and the implementation of

sustainable agricultural practices. These measures can help to promote carbon sequestration, enhance soil health, and improve biodiversity.

Pacific partnerships in sustainability often have an understanding of natural capital at their heart. AIIA Member Accenture assisted the small Pacific Island nation of Tuvalu by creating a digital twin of a small Tuvaluan island, with the digital twin incorporated into a film of the nation's Minister for Foreign Affairs delivering his COP27 speech from the visual representation of the island. Please see Accenture and the Nation of Tuvalu Case Study for more information.

Waste Reform

Waste reform refers to the adoption of policies and practices that prioritise the reduction, reuse, and recycling of waste. The management of waste is a significant contributor to greenhouse gas emissions and a critical challenge for the Australian economy. Waste reform can help to reduce the carbon footprint of production and consumption, create new business opportunities, and improve environmental outcomes.

According to a report by the Australian Council of Recycling, the recycling industry in Australia generates AUD $15.9 billion in economic activity and supports over 50,000 jobs. The report also found that increasing recycling rates in Australia could reduce greenhouse gas emissions by up to 15 million tonnes per year. Examples of waste reform in Australia include the adoption of extended producer responsibility schemes, the promotion of circular business models, and the implementation of innovative waste management technologies. The introduction of container deposit schemes in several Australian states has been successful in reducing litter and increasing recycling rates, demonstrating the effectiveness of waste reform policies in achieving environmental and economic outcomes.

In summary, the circular economy, nature-based solutions, natural capital, and waste reform are critical to reducing carbon emissions and creating a sustainable future for the Australian economy. The adoption of these approaches can lead to significant economic benefits, including the creation of new jobs, the generation of economic activity, and the enhancement of environmental outcomes. With the increasing impact of climate change and the urgent need for transformative change, it is essential that the Australian government, businesses, and society prioritise the adoption of these approaches to ensure a sustainable and prosperous future for all.

What government and other partners can do to unlock innovation potential as the economy transitions and decarbonises

Governments can take several actions to unlock innovation potential in the transition to a decarbonised economy. These actions include providing funding for research and development in clean energy technologies, setting regulatory standards to encourage adoption, fostering collaboration between businesses and research institutions, supporting education and training programs, and promoting international cooperation. By implementing these measures, governments can facilitate the transition to a decarbonised economy by unlocking innovation potential.

Various partners, beyond governments, can work together to tackle sustainability challenges. The private sector can adopt sustainable practices and invest in sustainable technologies, NGOs can raise awareness and advocate for policy changes, academia can research and develop sustainable technologies and offer education programs, community organisations can engage with local communities and governments to implement sustainable initiatives, and international organisations can provide a platform for global coordination and capacity building. Collaborative efforts can help create a more sustainable future.

Conclusion and Call to Action

This paper has sought to demonstrate, through the combined weight of the action being taken by innovative AIIA ICT members and their motivated clients, that technology has a galvanising and enabling role to play in the global mission to reach net-zero.

Using technology self-reflexively, as a tool to solve the quandary of the environmental impact of that very tool itself, has led to remarkable advancements in sustainability within the ICT sector itself. From advancing energy efficiency and reducing energy usage through the technological improvements in energy-intensive ICT environments, to great strides forward in water positivity, closed-loop cooling and paperless solutions, the tech sector is leading the way in its own operations on sustainability.

Enterprise technologies when employed in a whole-of-supply chain context can reduce the carbon footprint of every kind of organisation, especially through renewable energy technologies, artificial intelligence, and tracking and tracing of emissions. This assists small, medium and large enterprises to comply with standards and regulations, progress ESG strategies, and meet net-zero targets. The ripple effect achieved by enterprise technologies can be mirrored by smart government policy initiatives. The role of research and development tax incentives, the recently announced Industry Growth Program, Net Zero Authority and the National Reconstruction Fund will be pivotal in accelerating Australia's transition to a net-zero economy. Government also has a strong role to play in managing the sustainability impacts of its own procurements, encouraging investment into green startups, and promoting cleantech innovation.

Government must accelerate the adoption and deployment of key critical technologies such as robotics, artificial intelligence and the Internet of Things to realise a future green economy where Industry 4.0 and Industry 5.0, with a core of green skills, powers the attainment of net-zero goals and adaptation to climate change.

A government and society equipped with an understanding of the powerful enabling role of technology in meeting sustainability goals will be well-positioned to achieve the core purpose of technology as humanity's 21st century tool: that is, helping us to solve the problems that confront us on a generational and global scale – climate change foremost among them.

Appendices

CASE STUDY: Kyndryl's Path to Net Zero

In our very first year as an independent company, Kyndryl made a commitment to sustainability by investing in and establishing our net zero goals and strategy. This involved building a cross-functional sustainability team and developing an emissions inventory baseline of our global operations, including the impact of our employees and value chain. This was a substantial undertaking, especially for a company in its first year of existence. Calculating this baseline involved collaboration across Kyndryl's approximately 90,000 employees in over 100 countries, as well as extensive preparation, including review of the Greenhouse Gas Protocol and collection and analysis of data from all aspects of Kyndryl operations. To ensure accuracy, we obtained third-party validation of our direct and indirect emissions (scope 1 and 2) calculations and are currently obtaining third party validation for our scope 3 emissions. Once the emissions baseline was developed, we built a unique model that quantitatively projects our emissions reductions through 2030, taking into account our business strategy, supply chain, and emissions reduction plans.

Using this extensive work, Kyndryl made the following commitments publicly in December 2022. Kyndryl will:

- Reach Net Zero emissions by 2040
- Reduce scope 1 and 2 emissions by 75% by 2030
- Achieve 50% reduction in emissions across its global enterprise by 2030
- Obtain 100% of purchased electricity through renewable sources by 2030

Kyndryl built these net zero goals in line with the scientific recommendations of the Intergovernmental Panel on Climate Change (IPCC) and the leading scientific frameworks.

These long and short-term net zero goals, and the strategy developed to get there, have laid the groundwork for company-wide emissions reductions for the next 17 years.

The efforts in our strategy produced the following results in 2021:

- Reduced energy consumption by **32,800 MWh**
- Enable the annual generation of **18,000 MWh** of solar energy,
- Reduced emissions by > **10,600 MTCO2e**
- Resulted in saving **$3.8 million**

Additionally, using a science-based approach we were able to include scope 1, 2, and 3 emissions from our global operations in our net zero goal within the first year of the company. Through the validation of our emissions and creation of the quantitative model, we are confident that our commitments will not just be empty promises but rather achieved goals through concrete action. Kyndryl's Path to Net Zero project has allowed us to take responsibility for our emissions and empowers us to make a positive global impact through emission reductions

CASE STUDY: GreenSquareDC WA1 – 96MW Green, ethical & responsible AI ready Data Centre

GreenSquareDC works to 5 Pillars of Sustainability. These are primarily made up of:

1. Reduced embodied carbon via reduced overall GFA – arising from higher density yet more energy and water efficient data halls and green building solutions such as green concrete & steel.
2. Alternative, lower emission cooling environments with potential for water positive outcomes and waste heat re-distribution.
3. Alternatives to Fossil Fuel – removal of Diesel fossil fuelled back Up Generators
4. 100% Renewable/Green Certified Power + Onsite Microgrid
5. Artificial Intelligence (AI) = More Efficient Operation.

Our innovative data centre design is focused on helping our customers deliver greater business value with far greater ESG consciousness and transparency. Sustainability is, and will always be, at the core of what we do.

With demand for data continually increasing, the data centre industry is expanding at a staggering rate. Data Centres provide the backbone to much of our economic, commercial and social lives.

They are however also some of the world's biggest consumers of power and water on earth and one of the planets biggest emitters of CO2 into the atmosphere.

GreenSquareDC's 5 Pillars to Sustainability provide the pathway towards the true net-zero future we should all hope and aspire to achieve.

Our operational style is to provide customers with flexibility and not a 'one size fits all' approach. Customers can then decide which solution suites their workloads and sustainability goals and can scale up or down at their choosing.

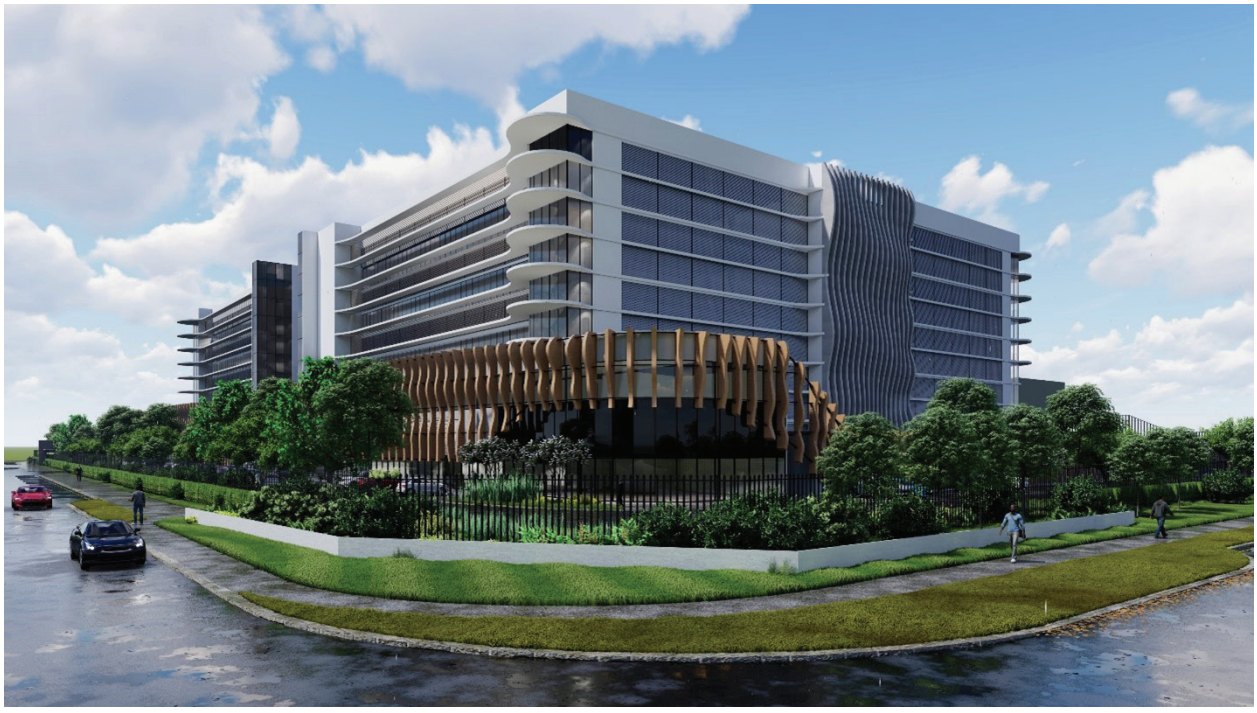
Whilst there is no 'magic bullet' to achieve Net Zero, our WA1 Data Centre project, with our 5 Pillars to Sustainability does put our customers on a clear and present pathway to Net Zero. Not only this, however our design also consumes considerably less water and has a considerably smaller overall environmental footprint than comparable incumbent co-location type data centres, with legacy engineering and legacy thinking.

If we don't commit to such measure as a country, an economy and a planet, we'll likely never to reach Net Zero by 2050. This is especially so with the emergence of generative AI such as ChatGPT. These processes are around 5 times more powerful or power-consuming than traditional data centres (looking at it from an indicative 'kW per rack' perspective).

The data center industry accounts for around 4% of global electricity consumption currently and many predictions have this set to reach over 10% by 2030.

Although the exact percentage of global power consumption by data centers by 2030 cannot be accurately predicted, it is clear that data centers are increasingly consuming significant amounts of energy. Various studies and predictions have been made, but the percentage of global power consumed by data centers can vary depending on several factors, such as improvements in energy efficiency, advancements in technology, and growth in the demand for data center services.

However, with the rapid growth of the digital economy, increasing use of cloud services, and the development of new technologies like AI and 5G, the demand for data center capacity is expected to continue to grow. As a result, it is crucial for the industry and policymakers to prioritise energy efficiency and sustainable practices in the design, construction, and operation of data centers to minimize their environmental impact.



CASE STUDY: Telstra harnessing Digital Technologies to Find a Path to Net Zero

Australia faces a major challenge to achieve its 2030 target of reducing greenhouse gas emissions by 43% below 2005 levels. While many [Australian?] businesses have committed to reduce their emissions, the Deloitte report notes that only a quarter of large businesses are on a trajectory to meet these targets.*

We believe digital technology is critical to taking meaningful climate action – while preparing business and society to continue to prosper in a low carbon future.

With the rapid adoption of emissions-avoiding digital technologies, Telstra, as Australia's largest telecommunications provider, has a major role to play in achieving Australia's environmental ambitions.

By 2030, Deloitte estimates that we can cumulatively help customers avoid over a huge 41 million tonnes of CO2e.*

To put this into context, our potential contribution to avoiding emissions is nationally significant – it's the equivalent of about 1% of the average annual reduction in emissions required to meet Australia's reduction target of 43% below 2005 levels by 2030.

For many businesses and government organisations, while the science on climate change is clear, the pathway to reduce emissions isn't. Increasing the adoption of new technologies such as smart HVAC, fleet management, remote working and cloud technologies are some of the ways Australia's offices, supply chains and warehouses can become greener.

To take a strong stance on the role our digital technologies play to help customers reduce their emissions, we first had to focus on setting meaningful and ambitious targets of our own – and making real progress to achieve them.

We are committed to reducing our absolute emissions by 50% by 2030 - across our business and for our suppliers and customers (scope 1-3 emissions). We have already reduced our scope 1 & 2 emissions reduction target by 14% and our scope 3 emissions reduction target by 31% from an FY19 baseline.

We are also committing to enabling renewable energy generation equivalent to 100% of our consumption by 2025 – and are 31% of the way there. Recognising the need for urgent action, we have also been carbon neutral in our operations since 2020.

* See the full Enabling Positive Climate Action Report by Deloitte for further detail, assumptions and qualifications.

More Information

Annual Sustainability report - https://exchange.telstra.com.au/wp-content/uploads/2022/08/Telstra-Bigger-Picture-2022-Sustainability-Report.pdf

Telstra Climate Change Report: Telstra Climate Change Report 2022

CASE STUDY: Deloitte Resilience Drought Self-Assessment Tool (DR.SAT)

Deloitte.

DR.SAT covers many areas of sustainability through pathways, which provide options to build or maintain resilience in the face of a changing climate, and is an example of technical innovation in sustainable agriculture.

The Drought Resilience Self-Assessment Tool (DR.SAT) received funding from the Australian Government's Future Drought Fund (FDF) which helps farmers and communities better prepare for drought.

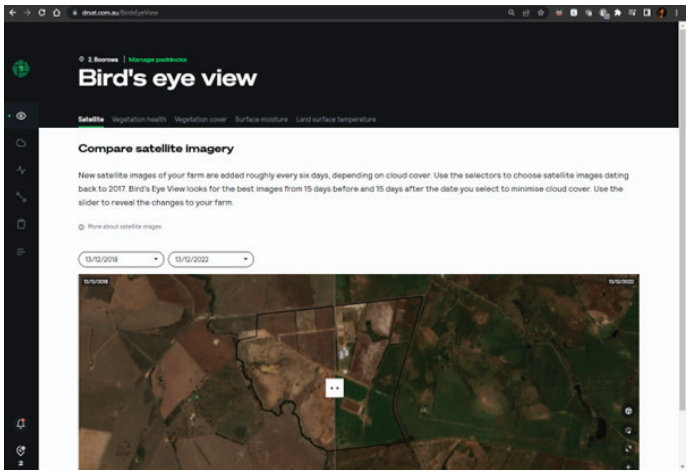
A key investment focus of the Fund is providing better climate information to farmers to support them to understand their climate risks and take action to build their resilience to those risks.

The Drought Resilience Self-Assessment Tool (DR.SAT) is a free tool for farmers to assess their resilience against climate change including drought and other climate risks. Resilience assessments include financial, personal and social, and environmental indicators.

Based on farmers' individual assessments, the tool provides tailored options and resources to support farmers to build resilience.

DR.SAT aims to inspire curiosity regarding:

1. What resilience means and how resilient the farmer and their farm may be.
2. Options and resources for how to build or maintain resilience in a changing climate.
3. How the land has changed over time through satellite imagery and remote-sensed data - at farm scale with regional benchmarking.
4. Farm level climate projections (linked to CSA) and commodity & region-specific climate impact information.



The pathways offered within the tool offer commodity and region-specific options for adapting to a changing climate.

More than 850 Australian farmers have created a free DR.SAT account and have access to climate data and satellite data for their farm. This gives them a view of how their land has changed over time and what the future projections show. It enables farmers to assess their current resilience and to explore pathways tailored to their particular circumstance.

More Information

CASE STUDY: AWS WATER POSITIVE BY 2030

- AWS has a commitment to be water positive by 2030. Being water positive means AWS will return more water to communities than it uses in direct operations. The four pillars of AWS's water-positive commitment are efficiency, recycling, reuse, and replenishment. AWS is partnering with global nonprofits to replenish water-stressed areas and return water to the communities where it operates.

  At AWS's data centres in Santa Clara, California, switching from the existing cooling system to a direct evaporative cooling system reduced annual water use by 85%.

- Five years ago, AWS and Umatilla community leaders worked together to develop a sustainable solution to recycle the water used to cool AWS data centres. The plan led to local municipalities and AWS investing in miles of new pipeline, allowing up to 96% of all spent cooling water from the nearby data centres to be reused in local communities. Before the water is delivered to farmers and used for cooling, AWS treats the water on-site, so it can be reused up to four times. This makes the water safe enough for cooling and irrigation.

- At the Zilla Parishad High School in Chittoor, India roughly 500 students and teachers line up at the hand-washing station each day. The water comes from a 2,500-liter storage tank that was constructed by WaterAid with support from AWS. This is one of the several AWS-funded replenishment projects in India. These projects with nonprofits like WaterAid and Water.org have increased access to safe water for nearly 300,000 people in India and Indonesia.

- In the United Kingdom, AWS is working with The Rivers Trust and local member trust Action for the River Kennet to create two wetlands on a tributary of the River Thames. The wetlands will recharge nearly 600 million litres of groundwater per year and improve water quality by receiving and treating polluted runoff from farms and roadways. This project will help address growing water scarcity and water quality in the Thames River basin.

More information

CASE STUDY: CDC and Closed-Loop Cooling

CDC Data Centres (CDC) has taken a deliberate approach to design and implement an innovative closed-loop cooling system to increase water efficiency across all facilities.

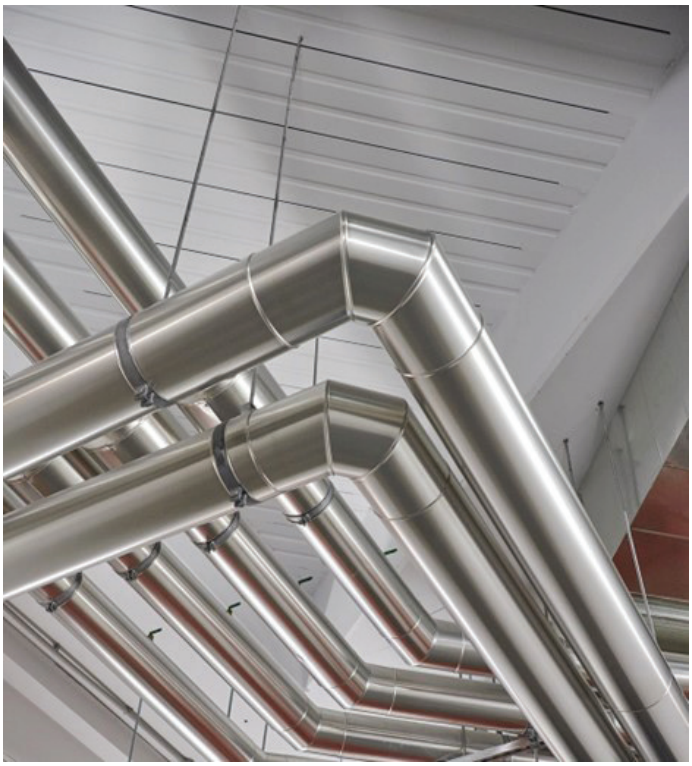
Data centres consume high levels of energy to power the IT equipment stored within their facilities and extract the heat they produce. The industry's reliance on water for heat extraction, via cooling systems, is crucial in preventing critical equipment failure.

Conventional cooling methods such as evaporative water-based cooling continue to be widespread and result in significant water loss. Consequently, these data centres require a continual supply of water for operation.

It is CDC's goal to become the most water efficient data centre provider and continue to lead the industry in water efficiency measures globally. CDC's innovative closed-loop cooling system eliminates the water waste that occurs in traditional cooling systems through evaporation, enabling the water saved to be used by the communities in which CDC operates.

This cooling system is a highly effective and efficient tool to minimise water usage and contribute to data centre water efficiency and water management, without compromising data centre operations.

The safe, secure storage of data is the foundation of a technologically advanced society. Data centres provide this critical service and with the exponential growth of data creation and demand, the requirement for data storage will also continue to grow. Historically, data centres have consumed large volumes of energy and water to operate their facilities.



CDC recognises their opportunity to play an integral role in setting new world-class data centre sustainability standards and inspire other providers to take a more ecological approach to their operations.

While increased attention has been paid to reducing the carbon footprint of data centres, the enormity of data centre water consumption has been largely viewed as a secondary concern, despite its emergence as a serious sustainability issue.

On average, traditional data centres consume more than three glasses of water (800 mL) per second for each megawatt of capacity. This is the equivalent of over 500 ML of water per annum for cooling per medium size facility. The magnitude of data centre water consumption is of particular concern to water-stressed regions as it adds pressure to an already limited supply, potentially depriving communities and other sectors of the economy of this vital

resource. It is projected that global water demand will increase by 55 per cent between 2000 and 2050, leaving a 40 per cent global water deficit by 2030 under a 'business as usual' scenario.

CDC's goal of becoming the most water efficient data centre provider is underpinned by the company's rigorous ESG strategy. This strategy aims to alleviate pressure on water supply and increase water efficiency by driving performance through target-setting, removing water consumption, and continuously innovating.

CDC has taken a deliberate approach to design and implement an industry-leading closed-loop cooling system, which eliminates the consumption of water for cooling across all its facilities. Each year, CDC saves up to 5 GL of water – the equivalent of 10 per cent of all water used in the ACT region annually. Reducing water consumption to zero enables this vital resource to instead be used by the communities CDC operates in.

Water efficiency remains a key focus of CDC. The company's proven ability to innovate enables it to continuously improve environmental and sustainability outcomes with each new build.

CASE STUDY: AWS Sustainable Cloud Infrastructure

Amazon is committed to reaching net-zero carbon emissions by 2040–10 years ahead of the Paris Agreement, as part of The Climate Pledge. Amazon is the world's largest corporate purchaser of renewable energy and is on path to powering its operations with 100% renewable energy by 2025. Amazon Web Services (AWS) is also working relentlessly to make the cloud the cleanest and the most energy-efficient way to run all of our customer's infrastructure and business.

In 2020, Amazon announced its commitment to offtake 262 megawatts (MW) combined in clean energy capacity across three utility-scale renewable projects in Australia. In May 2022, we announced our first Australian utility-scale renewable energy projects are now delivering clean energy to the Australian grid.

Other than our focus on renewable energy and improving the efficiency of our cloud infrastructure, the other contribution AWS is making is providing the power of innovation through cloud technology to drive sustainability solutions in Australia.

The two solar farm projects in Gunnedah and Suntop will aim to generate 392,000 MWh of renewable energy each year, equal to the annual electricity consumption of 63,000 Australian homes. Once Amazon Wind Farm Australia – Hawkesdale also becomes operational, it will boost the projects' combined yearly renewable energy generation to 717,000 MWh or enough annual electricity for nearly 115,000 Australian homes.

AWS is committed to running its business in an efficient way to reduce our impact on the environment. Our scale allows us to achieve higher resource utilization and energy efficiency than the typical on-premises data center. Multiple studies conducted by international analyst firm 451 Research, part of S&P Global Intelligence, found across several geographic regions that moving on-premises workloads to cloud data centers like AWS can lower the workload carbon footprint by nearly 80% and up to 96% once AWS is powered with 100% renewable energy, by 2025.

AWS is also using innovation to improve power efficiency by investing in our chips. Our third generation Arm-based processor AWS Graviton3, is more energy efficient, as Graviton3-based Elastic Cloud Compute instances use up to 60% less energy for the same performance than comparable Amazon EC2 instances.

AWS is helping Australian entities move toward meeting their sustainability goals by migrating to AWS and realising a carbon footprint reduction in line with the findings of the 451 research report. Once on the cloud, AWS helps customers optimise their workloads to improve their sustainability in the cloud through tools such as the Sustainability pillar for Well-architected and the customer carbon footprint tool. We help our customers understand the environmental impacts of the services they use, we quantify impacts through their entire workload lifecycle, and apply best practices to reduce these impacts. This could include identifying opportunities to leverage Graviton3-based Elastic Cloud Compute instances.

AWS provides tools and solutions to customers that accelerate the pace of innovation. Our customers use AWS to ingest, analyze, and manage sustainability data and choose AWS for the broadest and deepest set of capabilities in artificial intelligence (AI), machine learning (ML), Internet of Things (IoT), data analytics, and computing to reach their sustainability goals. An example is Brighte, which is built on the AWS Cloud and today partners with more than 2,000 solar retailers nationally and has helped more than 110,000 Australian households acquire

solar energy solutions. Another example is a solution built with Deloitte Consulting LLP and AWS which enabled Jemena to predict electricity consumption patterns and send proactive communities alerts ahead of outages or other extreme weather events.

AWS is helping Australian entities move toward meeting their sustainability goals through migration, optimisation and transformation, while investing and innovating to help create more sustainable cloud infrastructure.

More Information:

https://www.aboutamazon.com.au/amazons-first-solar-projects-in-australia-start-producing-clean-energy

https://d1.awsstatic.com/institute/The%20carbon%20opportunity%20of%20moving%20to%20the%20cloud%20for%20APAC.pdf

https://aws.amazon.com/startups/prove-whats-possible/brighte/

https://bpc-digital-gsi.s3.us-west-1.amazonaws.com/AWS+Sustainability+ebook.pdf

https://aws.amazon.com/blogs/aws/now-open-aws-asia-pacific-melbourne-region-in-australia/

CASE STUDY: UNSW Sydney net zero: putting our research into action

UNSW Sydney has achieved net zero operational emissions using homegrown photovoltaic technology. The PERC silicon solar cell was pioneered at UNSW in the early 80s by Professor Martin Green and the late Professor Stuart Wenham. Today, over 85% of all new solar panel modules produced worldwide use this technology. The Sunraysia project, which is dedicated to supplying the University with power, contains approximately 140,000 panels of PERC solar cells that generate over 200MW of electricity at peak output – enough to power 50,000 homes.

UNSW switched to 100% renewable electricity through a landmark solar Power Purchase Agreement (PPA) signed in 2020. The PPA brought together a consortium of developer, Maoneng Australia (to build and manage the Sunraysia Solar Farm), retailer, Origin Energy (to manage the intermittency of solar electricity), and UNSW. In combination with energy efficiency measures, new onsite solar projects and purchased carbon credits for residual emissions, we achieved net zero operational emissions (scope 1 and 2) the same year, a status that has since been maintained.

UNSW continues to expand onsite solar PV capacity and eliminate the use of fossil fuels through electrification. Between 2019-2021, we added four new rooftop solar PV systems, bringing total capacity to 1.2MW. One of these systems powers six new electric vehicle (EV) chargers - amongst the largest EV charging facilities in Sydney. A new solar 140 PV system was completed at Paddington campus this year.

In 2020, UNSW also became the first university in Australia to calculate and publish a comprehensive value chain emission footprint, in accordance with best practice for emissions accounting, the Greenhouse Gas Protocol and Corporate Value Chain Standard. We discovered that over 80% of our emissions were indirect (scope 3), resulting from supply chain, investment activities, travel, commuting, waste, and tenants.

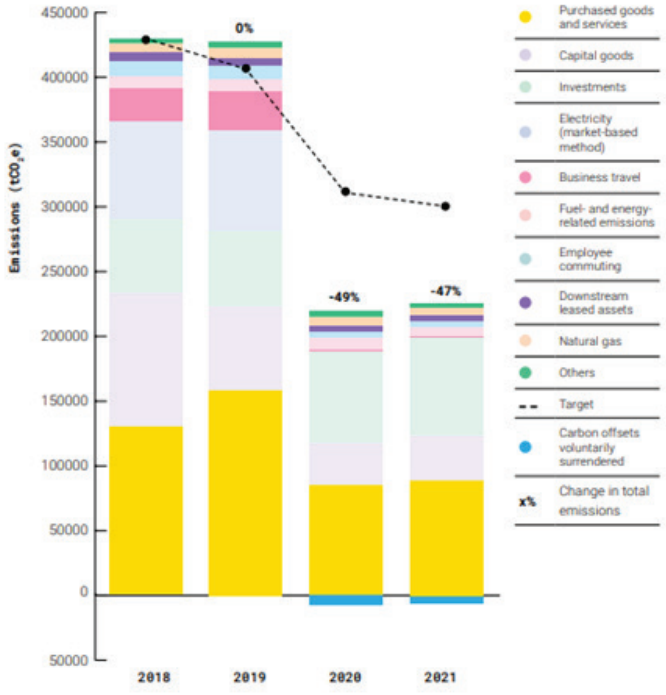
In line with global efforts to limit temperature increase to 1.5°C, we set a target to reduce total (scope 1-3) emissions to 30% by 2025, 50% by 2030 and net zero by 2050.

In the past two years, UNSW has established a process for assessing the targets and actions of our suppliers through our standard tender process and templates. We have also created an engagement pack that sets out expectations and completed a survey of suppliers to understand their current emissions status.

Benefits realised (summary of benefits achieved with any data points):

At UNSW, we're committed to reducing our impact on the environments in which we live, work, and learn, and to sharing our climate science and sustainability expertise generously.

By harnessing our own world-leading solar photovoltaic (PV) technology to power our business, UNSW saves approximately 77,500 tonnes of carbon dioxide equivalent (tCO2e) per annum (based on 2019 emissions). We also purchase carbon credits to offset residual emissions from natural gas usage and other scope 1 emissions, equating to a further 8,600 tCO2e per annum.



UNSW's greenhouse gas and target 2018-21

UNSW has made significant progress addressing scope 3 emissions in key areas including supply chain, IT, travel, investment, and waste. These have been tackled through the collective effort of students, staff, suppliers, and other external partners. As of 2021, we recorded a 47% reduction in total emissions, meeting our 2025 target early and placing us on track to meet our 2030 target. A complete inventory of direct and indirect emissions of UNSW operations is published in the annual Environmental Sustainability Report.

Emissions scope / category	Emissions (tCO_2e)			
	2018	2019	2020	2021
Scope 1: direct emissions	**8,045**	**8,860**	**8,089**	**7,445**
Natural gas	6,302	7,007	6,344	6,237
Liquid fuel for transport	801	934	807	449
Liquid fuel for stationary energy	59	59	44	43
Refrigerant and laboratory gases	631	608	642	467
Livestock emissions	252	252	252	248
Scope 2: indirect (electricity) emissions	**74,398**	**77,509**	**70,810**	**64,220**
Electricity (location-based method)[1]	74,398	77,509	70,810	64,220
Scope 3: indirect (value chain) emissions	**345,705**	**340,551**	**211,217**	**217,414**
Category 1: Purchased goods and services	129,698	157,834	84,468	88,518
Category 2: Capital goods	102,814	64,152	32,817	33,941
Category 3: Energy-related emissions	9,292	9,753	8,926	6,779
Category 5: Waste generated in operations	1,757	3,766	2,451	2,180
Category 6: Business travel	25,903	29,585	1,844	743
Category 7: Employee commuting	11,553	9,949	5,745	4,427
Category 13: Downstream leased assets	6,851	6,764	4,931	4,566
Category 15: Investments	99,496	104,533	120,677	80,533
Sub-total (before surrenders)	**428,148**	**426,919**	**290,116**	**289,078**
Scope 1 voluntary surrenders (ACCU, VCU)	-	-	8,089	7,445
Net scope 1 emissions (including offsets)	**8,045**	**8,860**	**0**	**0**
Scope 2 voluntary surrenders (LGC)[2]	-	-	70,810	64,220
Net scope 2 emissions (market-based)	**74,398**	**77,509**	**0**	**0**
TOTAL EMISSIONS (excluding offsets)[3]	**428,148**	**426,919**	**219,306**	**224,858**
Net emissions (including offsets)	**428,148**	**426,919**	**211,217**	**217,414**

UNSW's total greenhouse gas footprint 2018-2021

Beyond net zero goals, the establishment of the Sunraysia Solar Farm near Balranald in NSW has contributed to the development of the region, creating jobs and economic growth. The farm has been incorporated into educational programs and is visited by UNSW students for research, data exchange and case study purposes.

How does this project help the economy reach the net-zero by 2050 carbon goal?

UNSW aims to be a global leader in climate action and support peers and the wider community along the journey to net zero. Through research, education, and leadership, we're working to transform the Australian and global economy, build climate resilience and create green jobs and industries.

The UNSW GHG inventory is, to our knowledge, the most comprehensive of any university in the world and is publicly available to assist other organisations who wish to measure and reduce their value chain emission sources and develop a science-based pathway to net zero. In 2020, UNSW was the first Australian university to include scope 3 emissions as part of its target but since then, other universities have started to do the same.

The PPA project has also broken new ground in Australia and modelled a mechanism for others to replicate. Solar energy arrangements like UNSW's are critical in driving real change amongst large energy users.

More Information
UNSW School of Photovoltaic & Renewable Energy Engineering

UNSW Environmental Sustainability Report 2021

CASE STUDY: Accentrue, Avanade and Microsoft – Duke Energy

Accenture, Avanade—a joint venture between Accenture and Microsoft—and Microsoft are pioneering a methane emissions detection solution that will help Duke Energy achieve its ambitious net zero targets. This solution will also lay the foundations for tougher industry emissions regulations.

This first-of-its kind, end-to-end Azure-based platform monitors baseline methane emissions from natural gas distribution assets such as pipelines and gas meters, using satellite monitoring, analytics and artificial intelligence. The solution quantifies and prioritizes findings in reporting dashboards, making data easily consumable at multiple levels of the organization, including leadership, planning and field force management.

The platform is already delivering results. The geolocation data helps workers pinpoint leaks in minutes instead of months—and repair them more quickly. The solution also has the potential to identify system vulnerabilities and prevent future leaks. Once scaled, the platform will help Duke Energy's natural gas business reduce methane emissions and achieve its net-zero methane goals for 2030. Importantly, this solution has the potential to accelerate the journey to net-zero for the industry.

CASE STUDY: SAP & Lion – Optimising Supply Chain Sustainability

Through SAP Integrated Business Planning and Supply Chain Control Tower, beverage company Lion was able to streamline end-to-end planning to create a more sustainable process from innovation ideation to inventory optimisation in periods of stability and in periods where high levels of disruption from demand to supply to transportation exist.

Benefits include reduced risk of waste through better service levels by material and location and more accurate inventory levels.

> 99% NZ service level maintained after dropping inventory days by 15-38% across 18 materials in the IO pilot (Jan 2022).

Ability to see incremental volume, revenue and Gross Margin $ incl. the impact on the Supply Chain and Procurement in 2022 and beyond due to the inclusion of Pre-Gate 3 innovation.

More information

CASE STUDY: Cisco Sustainability Challenge

"Environmental sustainability is everyone's responsibility and increasingly a top priority for our customers. Cisco's own commitment to environmental sustainability starts at the very top. Our CEO, Chuck Robbins, has pledged 100% product return and ambitious *Net Zero GHG (greenhouse gases) emissions* goals by 2040. Cisco Partners play a critical role in driving sustainable outcomes for our customers, and the planet.

At Partner Summit last November 2021, we announced the Cisco Partner Digital Sustainability Challenge. This Challenge rewards Cisco partners around the world who are developing solutions using Cisco technology to help customers tackle climate concerns and achieve their own sustainability goals.

Digital Sustainability Challenge Criteria

Solutions submitted by partner teams focused on three criteria:

1. Show a Measurable Impact. Showcase solutions that measurably cut greenhouse gas emissions, minimise waste, and/or reduce energy consumption.
2. Accelerate Innovation. Share unique technology strategies and/or enable faster acceptance around customer adoption.
3. Demonstrate Collaboration. Tap into the power of collaboration to drive scalable sustainability-focused digital transformation and leverage the collective impact of Cisco together with our partners' unique expertise and perspectives.

Digital Sustainability Challenge Winners

Today we are thrilled to announce the Cisco 2022 sustainability partner challenge winners for Asia Pacific, Japan, China (APJC), Europe, the Middle East, Africa (EMEA), Canada and Latin America (AMER Int'l).

To see who won in the contest in the United States, check out John Moses' blog!

APJC

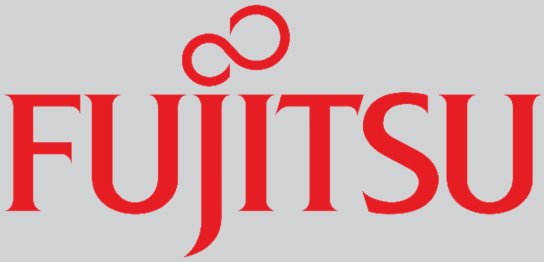
Madison Group Enterprise achieved the top prize in APJC! This *flood warning solution* provides a much-needed early alert system of expected floods with visualisation to predict flood levels and provide advanced warnings re-routing drivers and saving lives.

EMEA:

Earning the top spot at #1 is HCL Technologies – Their *Net Zero Intelligent Operations (NIO)* solution, developed by HCL Tech's dedicated IoT business unit, IoT WoRKS™, supports energy consumption optimization in an enterprise manufacturing environment to help customers reduce their carbon footprint."

More information

CASE STUDY: Fujitsu Australia Limited Power Purchasing Agreement (PPA)



"*Data centres are energy-intensive to run and by increasing our sourcing of renewable energy our data centre customers will also benefit from a reduction in their own carbon footprints, specifically their scope 3 emissions.*" – Graeme Beardsell, EVP, CEO Asia Pacific of Fujitsu.

In April 2022, Fujitsu Australia Limited (FAL) signed its first Power Purchase Agreement (PPA) to offset carbon emissions with renewable energy sourced from CWP Renewables' Sapphire Wind Farm, the largest operational wind farm in New South Wales (NSW). The 10-year agreement is the largest PPA undertaken in the Fujitsu Group, in line with achieving its science-based emissions reduction targets.

The Fujitsu Group has established a roadmap for reducing CO2 emissions to zero in 3 phases by 2050. This is in keeping with our desire, as a responsible, global ICT company, to strive to create a decarbonised society.

From its commencement date of 30 June 2022, the PPA is projected to offset around 30 000 tonnes of Fujitsu Australia's carbon emissions each year and provide renewable electricity equivalent to around:

- 40% of Fujitsu Australia Limited's total scope 1 and 2 emissions, or
- about 30% of Fujitsu's annual Australian electricity consumption, or
- the yearly energy needs of approximately 9 000 NSW homes.

Sapphire Wind Farm's Community Fund splits $187 500 between the Inverell Shire and Glenn Innes Severn Councils annually, based on the number of turbines installed in each area. Local non-profits can request funding for the purchase of small equipment and infrastructure, renovation and rehabilitation projects, and assistance with new programs and events.

"Through this PPA, Fujitsu is not only contributing to the transition to net zero emissions, but supporting ongoing regional investment, which Sapphire Wind Farm provides through jobs, community investment and sponsorships." - Jason Willoughby, Chief Executive Officer of CWP Renewables.

There are competitive advantages to being a sustainability leader: entering a corporate PPA with a renewable energy generator can increase price certainty for a business and reduce its emissions, improving its environmental reputation. Fujitsu's purpose globally is to make the world more sustainable by building trust in society through innovation. Many Fujitsu customers are on a similar journey and decarbonising our operations carries positive effects for their scope 3 emissions as well.

The positive environmental impact of this project was recognised at Fujitsu Group's annual Sustainability Contribution Awards, which is presided over by Fujitsu Group's Managing Director.

This agreement marks a key step for Fujitsu Australia in decarbonising its operations and providing lower-emissions services to its customers. The transition to renewable energy will support the Fujitsu Group's progress towards its global carbon reduction target of 71.4% by 2030, compared with 2013 levels, and 100% by 2050.

Fujitsu's 6 data centres (DCs) in Australia account for more than 95% of both our energy use and our total greenhouse gas (GHG) footprint across the Australia and New Zealand region, making DC sustainability a material focus for Fujitsu. The first Australian provider to obtain NABERS certification across all facilities, we're recognised as achieving efficiencies 33% higher than the industry average.

In addition to the PPA, we continue to invest in more efficient and lower-carbon operations of our enterprise-grade DC facilities to support our customers, who are dealing with rapid digital transformation (DX). Our data centres are equipped with green solutions such as LED lighting, optimised air flow and energy-saving compressor schedules, while our Eight Mile Plains Data Centre uses energy from its rooftop solar system. Customers are also provided with offsets. In addition, we offset emissions from our vehicle fleet and work with suppliers to reduce their footprints.

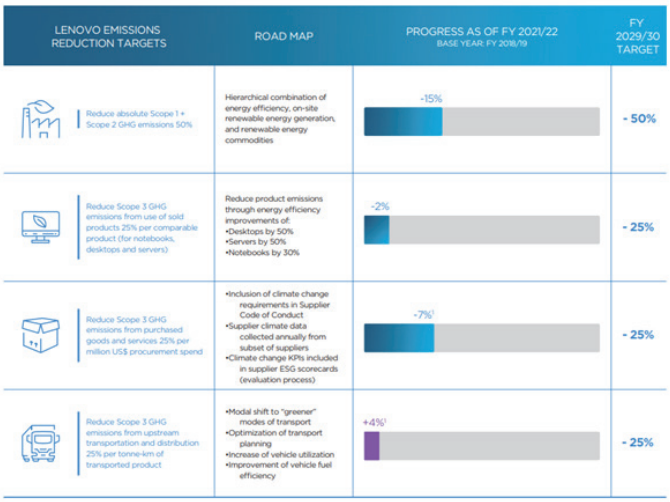
Finally, with the ICT industry estimated to be responsible for 2-4% of the world's total emissions, Fujitsu aims to use its DX capabilities to reduce, and ultimately reverse, that share of emissions. Our proprietary Sustainable Digital Transformation Accelerator measures the full environmental impact of a customer's ICT estate, identifying opportunities for cost and emission reduction as well as improving due diligence and measurement.

More Information

- Fujitsu Australia signs its first power purchase agreement in a key step towards decarbonising its operations and providing lower-emissions services : Fujitsu Australia
- Latest News – Fujitsu Australia signs first renewable energy PPA with CWP Renewables | CWP Renewables
- Fujitsu Sustainability & Environment : Fujitsu Australia
- FUJITSU Climate and Energy Vision : Fujitsu Global
- Responsible Business Report for Fujitsu Australia and New Zealand : Fujitsu Australia
- Data Centre Services & Solutions in Australia : Fujitsu Australia

CASE STUDY: Lenovo: Envisioning Net-Zero by 2050

Lenovo is fully committed to carbon footprint reduction in its operations. After exceeding our 2020 carbon emissions reduction target, we have set a vision of achieving net-zero by 2050, and we are working with the Science Based Targets initiative to determine the goals that support this vision.



Sustainable Packaging

Lenovo has continued its focus on resource preservation and supporting a circular economy by increasing the use of recycled and recyclable materials in packaging, increasing the use of bio-based materials, reducing the size of packaging, and expanding the use of bulk and reusable packaging solutions that help to reduce carbon emissions. Since 2012, we have been using bamboo fibre in packaging, a renewable, bio-based and lightweight material. We have continued to increase our use of this material, and are now using it in the packaging for more than one million products each year. In FY 2021/22, we expanded our use of bamboo fibre to include the ThinkPad X1 and Z series gift boxes, thus reducing the transportation weight by 30 percent.

Lenovo CO2 Offset Service

Lenovo's industry-first CO2 Offset Services gives organisations a chance to compensate for emissions by investing in environmental schemes.

2021	• Expanded the use of CL PCR to 248 products • Introduced Ocean Bound Plastics in five products • Introduced recycled aluminum in three products and magnesium in one product
2020	• Expanded the use of CL PCR to 103 products, up from 66 products the previous year • Began using CL PCR in a server application for the first time in the Company's ThinkSystem SR950
2019	• Expanded use of CL PCR to 66 additional products • 1st Use of CL PCR in Lenovo notebook application (X1 Carbon 7th Generation) • Desktop and visual models with >25% CL PCR by total product weight
2018	• Qualified new grades of CL PCR for additional resin chemistries and suppliers • Expanded use of CL PCR to 21 products (added keyboards)

Only Lenovo customers can purchase their PC products CO2 compensated over the device's lifecycle. We can provide CO2 Offset Services to customers to help achieve their sustainability goals. Developed to support UN Climate

Change projects, this service will provide customers with the opportunity to compensate CO2 emissions by investing in environmental schemes.

What sets Lenovo's CO2 Offset Service Apart:

- Lenovo is the only vendor that provides tangible proof of CO2 being compensated
- Transparent way for customer to offset carbon emission from Lenovo hardware through contribution to one of several United Nations Climate Action projects
- Audited and Certified Product Carbon Footprint (PCF) Calculation
- Process is 3rd party validated by DEKRA, a reputed global product testing and certification company
- Simplest Order Process offering a tailored approach to CO2 compensation, directly linking to products purchased unlike any other CO2 emission trader in the market

Liquid Cooling Technology

Lenovo's Neptune liquid cooling technology, combined with our High-Performance Computing cluster, helps datacentre customers become more energy-efficient. For example, they enable our customer, DreamWorks Animation, to cut power consumption by a third while increasing the amount of computing power per square foot of its existing datacentre by more than a hundredfold, which creates a real-time rendering process for creative artists

Smarter Manufacturing: Low-Temperature Solder

Lenovo's engineers continue to seek solutions that support our climate change mitigation goals in the manufacturing process, while also providing reliable products with a lower carbon footprint. In 2017, Lenovo pioneered an innovative low-temperature solder (LTS) technology that did just this. As Lenovo carries out their recently announced science-based targets, LTS technology is supporting its progress towards its climate change mitigation goals. We are working to expand the use of this technology and drive benefits that extend beyond the environment, including improved reliability, efficiency and cost.

From FY 2021/22, Lenovo greatly extended this technology to more and more sub-module vendors, who produce parts such a SSD, wireless, display panel, memory, and human interface device modules, and also sharing this technology to industry openly, supporting low carbon footprint transformation.

In FY 2021/22, Lenovo shipped 14.2 million laptops manufactured with the LTS process, and total shipped since 2017 has reached 50 million. This has resulted in a total reduction of 10,000 metric tons of CO2 emissions.

Renewable Energy

Lenovo has continued to expand our renewable energy installation as we work to achieve our energy-related targets. The total in-operation renewable energy capacity in our worldwide locations has now reached approximately 17 megawatts, with more in the plan.

Supplier Sustainability

Our efforts to effectively engage with suppliers on climate change were acknowledged when we achieved a CDP score of "A" for our 2021 Supplier Engagement Rating in Climate Change, and we were also listed on the Supplier Engagement Rating Leader Board along with a total of 518 companies.

More Information
https://news.lenovo.com/pressroom/press-releases/lenovo-commits-net-zero-by-2050-validated-by-science-based-targets-initiative/

https://investor.lenovo.com/en/sustainability/sustainability_reports.php

CASE STUDY: SAP and Coldplay's Music of the Spheres Tour: Helping five million fans make smarter choices for our planet

SAP worked with Coldplay to develop the Coldplay Music of The Spheres World Tour app to help make their tour more sustainable. The app is made up of four sections powered by SAP Analytics Cloud, SAP Business Technology Platform and SAP Cloud for Sustainable Enterprises.

1. The app encourages fans to select greener travel options and provides the visibility into their own carbon footprint. Fans can calculate the impact of their travel to and from shows, selecting from seven different modes of transportation.

2. The app provides the band's team to gain insight into the environmental impact by concert, country, and continent to better understand how they will offset emissions throughout the tour.

3. The app creates awareness by enabling fans to gain insights into Coldplay's sustainability efforts through interactive sustainability-themed games and find information about the band's sustainability partners.

More information

CASE STUDY: Deloitte Partnering With Sydney Local Health District – Digitising Sustainability Reporting With Net Zero Cloud

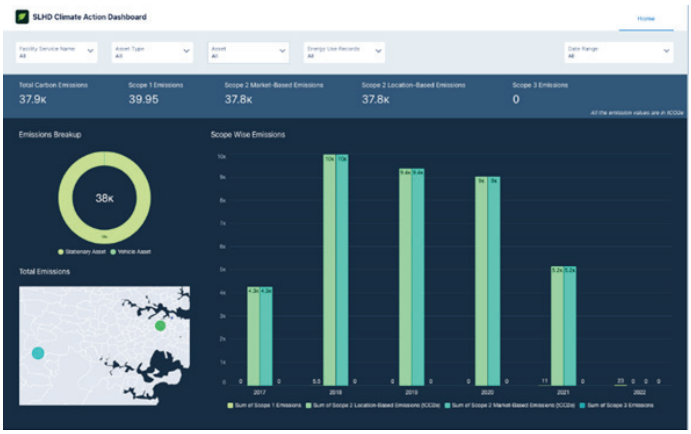
Deloitte.

Sydney Local Health District saw an opportunity to digitise how they report on sustainability and partnered with Deloitte to develop a new pilot system for Canterbury Hospital. The Local Health District has increasing focus around using sustainability data to transform how they operate, and this pilot is the first step to move their sustainability reporting into the cloud, to bring greater transparency to their operations, and ultimately allow data to steer sustainability decisions and investment across their supply chains and assets.

The final platform is an interactive dashboard and ESG management and calculation engine, which allows stakeholders to understand emissions across scope 1 and scope 2. The solution is built on Salesforce Net Zero cloud which provides key foundations to scale the platform to more use cases including around broader spectrum ESG reporting, including waste, water and circular economy reporting and complex scope 3 supplier management.

There are plans for a next phase of work to extend the pilot which will have a great emphasis on Scope 3, forecasting and abatement pathways.

Emissions across the health sector and related supply chains are estimated to be close to 5 percent globally.



This project provides a template for health industry to start tackling complex emissions in a methodical way using data and digital platforms. If the economy is to reach Net Zero by 2050, other industries will need to follow

a similar approach by developing real time monitoring tools for supply chains and assets, so they can look at capital investment required to transform their industries to become Net Zero.

CASE STUDY: Helping Customers Go Green – Enabling Positive Climate Action Through Digital Tech

In 2022, we set out to understand the role technology plays to help take action on climate change – and how we can help customers to reduce emissions through the use of our products and services.

We commissioned Deloitte to support*, and they found that in 2021, we enabled our customers to avoid 2.7 million tonnes of carbon dioxide equivalent (CO_2e) emissions, comparable to taking 820,000 cars off Australian roads each year.

Deloitte's findings estimate that by 2030, our enablement factor will be 6.9. That means for every tonne of CO_2e we emit, we would help our customers avoid 6.9 tonnes of CO_2e emissions through the use of our products and services – the equivalent of reducing the number of cars on Australian roads by 1.3 million each year.

Some examples –

- Heating, ventilation and air conditioning (HVAC) is responsible for the majority of building emissions because of the power used to regulate temperature (HVAC accounts for up to 50% of total energy consumption in commercial buildings). Smart HVAC systems automate the processes to regulate energy use and in doing so increase energy efficiency and reduce emissions – e.g. automated switching on air con when a monitor sensors detect that someone has walked into a room and then respond to the changes in a room such as number of people and temperature of the day). The technology which is available today can have a dramatic impact on the reduction in carbon emissions.
- Switching to cloud computing can save a business up to 80% of their computing related emissions without doing anything else. This will become more important as we use more compute in our daily lives.
- IoT has the potential to optimise agriculture, logistics, fleet management as well as reduce fuel use and use energy more efficiently and reducing emissions.
- Climate smart agriculture provides technology solutions that efficiently manage agriculture assets. This sector accounts for 15% of Australia's emissions (4th highest emitting sector in Australia). Connectivity enables IoT sensors and robotics to increase production and reduce waste (e.g, direct monitoring of root systems to identify optimal soil, weather and water conditions or real time tracking of cattle and/or feeding equipment).

* See the full Enabling Positive Climate Action Report by Deloitte for further detail, assumptions and qualifications.

CASE STUDY: Infosys' ESG Journey

Infosys strongly believes that Practical Sustainability can solve half of the sustainability challenges using today's technologies in about five years. Infosys is the only carbon-neutral systems integration firm that operates at scale. Learning from its experience, Infosys delivers Practical Sustainability solutions to clients globally today.

Infosys ESG journey started in 2008 with specific focus on all aspects of **Environmental** (emissions, waste, water, buildings, power, greenhouse gases), **Social** (employee experience, jobs, societal impact, human rights) and **Governance** (data collection and reporting, diversity, inclusion, and privacy).

Infosys has implemented significant changes in its operations to achieve industry leading ESG objectives. Some of these include:

- Operational excellence through accurate monitoring & retrofits where 40,000+ connected assets were installed across campuses, delivering over 500,000 data points any given time
- 28M+ Sq Ft LEED Platinum campuses
- 60MW Installed Solar capacity
- Community-based Carbon Reduction programs
- Tech for Good targeting 80M+ lives
- Benchmark design and operations of buildings with lowest EPI of 70 kWh/m2/ yr
- Efficient data centres at a PUE of < 1.5
- Hiring practices to promote diversity
- HR practices that promote inclusion
- Organisational and training practices to support privacy (Privacy By Design)
- Infosys has consistently been recognised for its transparent accounting, reporting and disclosure standards along with board diversity

Infosys has received several accolades in its journey:

- Wall Street Journal: "World's 100 Most Sustainably Managed Companies"
- Ethisphere: "World's Most Ethical Companies"
- UN: Global Climate Action Award
- Ecovadis Gold Medal
- Dow Jones Sustainability Index
- Leading ratings by HFS, Everest, IDC and ISG

Infosys has developed strategic partnerships with industry leaders like The Economist Group, Financial Times, MIT, UC Berkeley, Arizona State University, World Economic Forum, Google, AWS, Microsoft, SAP, Salesforce, IBM, Celonis, Software AG, IBM enVizi, eka, vantiQ, .planetly, coupa, BlueYonder and several more.

Infosys has been an industry leader in achieving ESG goals because of its solid sustainable vision. Infosys is the first Indian company to commit to RE100 i.e., 100% of its operations will be run by electricity from renewable energy.

Infosys has achieved stellar results because of its sustainable planning. Some of these include:

- Carbon Neutral as of 2020 covering Scopes 1,2,3; – 30 years ahead of the Paris Agreement objective and way ahead of many peers and several industries
- Infosys is the only carbon-neutral systems integration firm that operates at scale
- Have achieved and maintained carbon neutral status without purchasing carbon offsets
- 55% reduction in electricity used
- 64% reduction in water used
- ~50% renewable electricity used in India
- Connected load reduction of 34 MW since 2008
- Zero plastic in Infosys campuses in India
- Avoided 200,000 tons of firewood

- 11 of 17 United Nations SDGS impacted through our carbon offset projects
- 12 Carbon offset projects across 6 implementation partners, 5 states, 24 districts, 5000+ Villages with 220,000 beneficiaries
- Created 2800+ rural jobs
- Special focus for gender diversity at Tech Lead + level
- Special focus for women to return to work after career breaks

More information:

https://www.infosys.com/about/esg.html

https://www.infosys.com/content/dam/infosys-web/en/about/corporate-responsibility/esg-vision-2030/esg-journey.html

https://www.infosys.com/content/dam/infosys-web/en/practical-sustainability-book/index.html

CASE STUDY: SAP and Iberdrola – How can smarter, more sustainable procurement processes help achieve carbon neutrality?

With automated digital procurement processes by SAP, Iberdrola increased efficiency and improved its ability to assess the environmental impact of its suppliers, helping to secure the best price on sustainable materials, products and services.

This provides users insight into the environmental impact of the supply chain, enabling them to make well-informed purchasing decisions, helping to ensure that, by 2022, at least 70% of key suppliers demonstrate a commitment to sustainability.

Iberdrola gained a detailed view of the sustainability of the supply chain, empowering teams to make smarter purchasing decision based on environmental sustainability goals (ESG) criteria.

Iberdrola: How Can Smarter, More Sustainable Procurement Processes Help Achieve Carbon Neutrality? (sap.com)

CASE STUDY: Accenture and the Good Food Institute

Accenture is partnering with the Good Food Institute, a nonprofit promoting plant-and cell-based alternatives to animal products, to develop the vision, strategy, and operating model for a "moonshot" initiative that will speed the transition to alternative protein.

Through deep research and development, growth and innovation models, intellectual property licensing, and branding, the organisation will be able to scale market adoption, unlock tremendous commercial growth, reduce reliance on factory farming practices, curb greenhouse gas emissions, and mitigate biosecurity threats like zoonotic pandemics.

CASE STUDY: Accenture and the Australian Institute of Marine Science

Coral is critically endangered. In fact, scientists estimate that 75% of reefs are severely threatened. While conservationists are hard at work monitoring 70% of reefs, they struggle to synthesize the data collected before it's outdated.

So, the Australian Institute of Marine Science (AIMS) and Accenture designed an open access tool called ReefCloud. It automatically analyzes reef photos and translates the data into insights and recommendations, standardizing data and enabling rapid interpretation, reporting, and communication across languages, geographies, and scientific methodologies. Using artificial intelligence (AI), ReefCloud produces estimates of coral reef composition with 80% to 90% accuracy at a speed 700 times faster than manual efforts.

And with 200+ users globally, it enables scientists to share data and collaborate faster. But ReefCloud is more than just reefs—it can be scaled across other ecosystems, demonstrating the unlimited potential of technology, design, and expert knowledge to transform how we solve the world's greatest challenges.

CASE STUDY: Optus Eco

OPTUS

Optus has launched Optus Eco, to empower our customers who wish to make a positive impact on their environmental footprint. Optus Eco empowers our customers to reduce their impact on the environment in 3 simple steps – reduce, offset, and amplify:

1. Making simple changes to how they connect – Switch to paperless billing, recycle their old device, modem, or accessories through our partnership with Mobile Muster, donate unwanted phones through our Donate Your Device program or connect with an Optus eSIM instead of the usual plastic SIM cards.
2. For 60 cents a month, customers can offset some of their mobile's environmental impact and support Australian carbon reduction projects.
3. Once customers have ticked off the "challenges" in Optus Eco, Optus will match their carbon offsets.

In FY22, we improved on our carbon emissions intensity from 0.08 tCO2e/TB in FY2021 to 0.06 tCO2e/TB and reduced absolute Scope 1 and 2 emissions 428,458 tCO2e in FY21 to 394,253 tCO2e.

Since the launch of Optus Eco, we have had over 500,000 users use this feature. Optus has proudly partnered with environmental project developer GreenCollar to source Australian carbon reduction projects like Boonora Downs in NSW and Tallering Station in WA. By offsetting their mobile carbon emission, customers will help support these projects which reduce carbon emissions and improve biodiversity. We have also made progress on our circular economy targets, achieving a 95% recycling and reuse rate for all our electronic waste and even launched a more sustainable modem in December 2023. Our new generation modem is made of 95% recycled plastic and is packed in a 100% recyclable packaging, containing no single-use plastics.

We also provisioned approximately 930 mobile devices through our Donate your Device program that invites customers to donate their eligible preloved phones to people who need them most. With the help of our trusted charity partner, Good360 Australia, donated devices are distributed to Australians in need across a range of areas including education, employment, and hardship.

That spare handset sitting in a drawer could help connect loved ones, power their potential through education, job opportunities, give access to vital services and open a new chapter of someone's life. At the same time the program helps keep unused devices out of landfill by giving them a new lease of life.

More Information

CASE STUDY: Optus' progress on environmental sustainability

Reducing our carbon footprint

Optus has taken tangible steps towards achieving our Net-Zero by 2050 goal for carbon emissions, making good progress on our commitment to reduce our absolute Scope 1 and 2 emissions by 2030 using Science-Based Targets.

Our priority is to reduce our operational emissions while also increasing the proportion of our electricity being backed by renewable sources. In 2022, we completed an assessment of our full Scope 3 emissions inventory to understand how we can reduce emissions from our supply chain activities. We also announced in March 2022, our commitment to have 100% of our electricity consumption backed by renewable energy sources by the end of 2025.

To help us reach our goals and allow our investors to participate in our sustainability journey, we tapped innovative sources of finance, becoming the first telco in the Asia Pacific to issue a Sustainability-Linked Bond Framework. We then successfully issued a A$300 million sustainability-linked bond (tied to our emissions reduction commitments).

Our Circular Economy Roadmap for packaging, launched in 2022, sets out our pathway to achieve targets of 100% recyclable, reusable or compostable packaging by 2025 and ambitious goals to increase the amount of Optus branded products with renewable or recycled materials. We are now underway for our Circular Economy Roadmap for our corporate waste.

More Information

CASE STUDY: Amazon and Renewable Energy

Amazon is the world's largest corporate purchaser of renewable energy and is on a path to powering our operations with 100% renewable energy by 2025—five years ahead of our original target of 2030.

In 2021, we reached 85% renewable energy across our business, and announced renewable energy projects across 18 countries.

Our first solar projects in South Africa and the United Arab Emirates came online, and we announced new projects in Singapore, Japan, Australia, and China. Our projects in South Africa and Japan are the first corporate-backed, utility-scale solar farms in these countries.

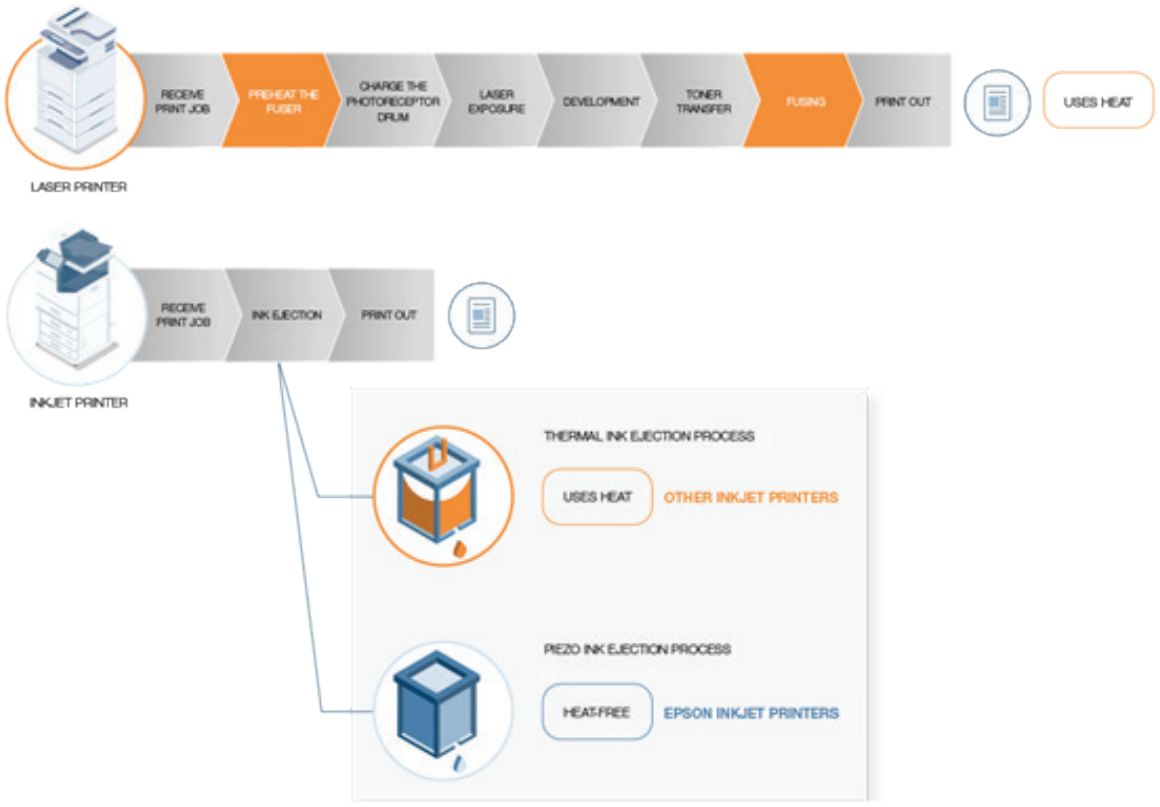
As of December 2021, we had enabled more than 3.5 gigawatts of renewable energy in Europe through 80 projects, making Amazon the largest purchaser of renewable energy in Europe.

More information A
More Information B

CASE STUDY: Epson reducing the environmental impact of its customers

Epson is dedicated to developing technologies that help customers achieve their sustainability goals and reduce carbon impact. Many businesses are actively seeking ways to reduce costs and minimise environmental impact. An effective approach is to focus on employing energy-efficient and resource-efficient technologies.

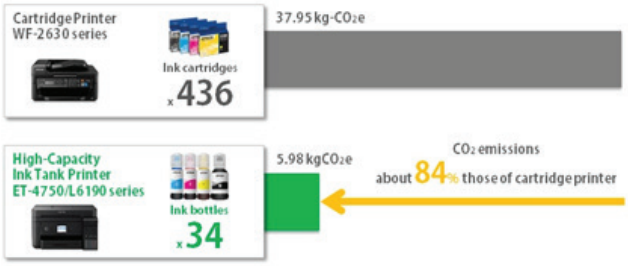
Electricity consumption constitutes a significant portion of greenhouse gas emissions for office-based businesses, with printers and photocopiers accounting for approximately 2% of energy consumption in office tenancies [69]. It makes investment in energy-efficient office appliances a cost-effective way to improve environmental impact. Epson's unique Heat-Free Micro Piezo inkjet technology uses just a ¼ of the energy of a laser printer[70]. Epson Heat-Free printers do not require heat in the ink ejection process. Instead, pressure is applied to the Piezo element, which flexes backwards and forwards firing the ink from the printhead.



69. Navigating a dynamic energy landscape – A briefing for office-based businesses, Energy Efficiency Council, 2020

70. Comparing Epson WorkForce Enterprise WF-C20600 with 26 competitive laser devices (45 to 69 ppm A3 colour MFD segment) as at 1st September 2022 according to data from Keypoint Intelligence.

Epson printers also user fewer consumables. Epson was the first to bring ink tank technology to market. Epson's EcoTank printers are equipped with a large capacity refillable tank instead of cartridges – reducing the amount of plastic used by about 84%[71].



**Comparison of CO2 emissions accompanying the manufacture, transport, and disposal of consumables, including packaging materials, assuming 50,000 A4 colour documents are printed over a period of 5 years. CO2 emissions were calculated based on Epson's evaluation conditions. Actual CO2 emissions will vary depending on customer printer use.*

Epson also offers an innovative digital textile printing technology that provides the clothing industry a less wasteful and more environmentally responsible means of textile production. Digital textile printing eliminates the plate-making process required in conventional analogue textile printing which use high volumes of water and harsh chemicals and if not processed and treated properly, can end up in waterways. Epson's Monna Lisa direct-to fabric textile printer series uses more environmentally friendly pigment inks, the ability to do short runs and thus allowing flexible responses to demand fluctuations and reduce waste associated with excess production.

71. Based on the bottle shipments for all CISS products from 2010 to June 2021. Material weight comparison of consumables (including packaging) between Epson ink cartridges and Epson ink bottles. The reduction ratio is varied by product category

Case Study: SAP's recycled plastic tracking for DIC Japan

Using SAP GreenToken Japan's DIC group can track the quantum of recycled content used in packaging, from the conversion of used plastic consumer packaging into plastic resin through to the final remoulded plastic tray that is used to store consumer foodstuffs.

1. Used cleaned Sushi trays are deposited by the public to the local collection point.

2. DIC assign GreenToken when they receive the waste trays for example 100 tonnes worth of GreenToken for 100 tonnes of sushi tray waste

3. DIC take the sushi trays and using a novel chemical / molecular recycling process convert the trays to create a plastic resin that can be formed into new trays

4. Using GreenToken they can track how much of the waste sushi tray plastic ends up in the production of the resin.

5. When turning the resin into a plastic tray a QR code is printed on the tray to show shows where the waste comes from. And what % is from this recycled source

6. Consumer can scan to see evidence using the GreenToken app on their phone.

This innovation reduces the amount of plastic produced and allows DIC to have recycled claims to be auditable and trackable.

It reduces the group's carbon footprint, as the DIC process is far less carbon intensive than creating the plastic solely from petroleum feedstock. This will also allow DIC to receive ISCC+ standard accreditation, a globally recognised sustainability standard.

More Information

CASE STUDY: Accenture and the Nation of Tuvalu

Tuvalu is a small Pacific Island nation in danger of being swallowed by rising sea levels due to climate change. To prepare for this worst-case scenario, Tuvalu seeks to build the world's first completely digitized nation.

The government of Tuvalu asked Accenture for help in delivering a compelling message at the 2022 United Nations Climate Change Conference (COP27), with an aim to save the country from a climate catastrophe. Accenture conceptualized and executed a campaign to highlight Tuvalu's emergency situation and urge governments to act immediately.

The campaign's centerpiece was a film of Tuvalu's Minister for Foreign Affairs delivering his COP27 speech from a digital twin (virtual representation) of a small Tuvaluan island. To build the digital twin, Accenture used a new technology to integrate real-world, movie-quality photos and drone footage into a highly realistic 3-D experience. Accenture designed and built a companion website, Tuvalu.tv, that broadcasts the speech to a global audience and enables visitors to send letters to their respective governments.

The digital twin created by Accenture serves as the first step in making a comprehensive digital nation accessible in the metaverse—a spectrum of digitally enhanced worlds experienced via the Internet. Tuvalu now is better equipped to pursue this vision if its worst-case scenario becomes a reality.

CASE STUDY: Epson's Closed Resource Loop Initiatives

Epson is committed to utilising resources more effectively to reduce carbon emissions associated with extracting and processing new resources while also mitigating the environmental burden of waste management. To prolong the lifespan of valuable resources, combat waste and promote the development of a circular economy, Epson offers a nationwide repair service, quality refurbished products, and recycling programs for end-of-life hardware and consumables such as cartridges and projector lamps. Since the inception of the Cartridges 4 Planet Ark (C4PA) program in 2003, Epson has recycled over 6 million units of ink cartridges avoiding over 255 tonnes of waste to landfill. A key innovative application of the recovered materials is a high-quality asphalt additive that is used to improve the durability of road surface in Australia[72]. In financial year 2022/23, Epson recycled 1,972 tonnes of e-waste which saved 2,678 tonnes CO2e[73].
CASE STUDY:

72. https://www.tonerplas.com.au/

73. Epson Environmental Impact report for Financial Year 2021-2022 based on Lifecycle assessment data produced by Lifecycles, Australia New Zealand Recycling Platform (ANZRP).

Adobe and RSM Australia: Streamlining client service and promoting sustainability

Outcomes of project:

- Move to fully digital workflows by 2024
- Integrate PDF and e-signature solutions with existing iManage document management solution
- Handle high volumes of key business and financial documents
- Achieve greater document security with best-of-breed solutions

Benefits realised:

- Completed **6,000 e-signature transactions within 30 days** of implementing new workflow
- Receive signed documents from clients in **one to two days**
- On track to process **70,000+ documents** in a year
- **Enabled easier signing processes** on mobile device

Based on 70,000 e-signature transaction against the Adobe Sustainability calculator RSM saved:

Used 2,090,152 grams of CO2 (89% Lower carbon footprint) against 19,529,857 grams of CO2 when using paper.

Link to Calculator - https://acrobatusers.com/resource-saver-calculator/

Saving 28,353 litres of water; 1,184 Kg of Wood; 187 Kg of Paper Waste; and 8,925,001 BTU Hours of Energy.

More Information
https://business.adobe.com/au/customer-success-stories/rsm-australia-case-study.html

CASE STUDY: Hewlett-Packard's Advancement of Circularity

Circularity

Transforming to a circular business

300

Since 2017, HP has launched more than *300* new products around the world containing ocean-bound plastic.

Product 13%

13% postconsumer recycled content plastic used in our products15 and more than 1,200 tonnes of ocean-bound plastic used, since 2016.

Packaging 44%

44% reduction in single-use plastic in our packaging16, since 2018, compared with a 19% reduction in 2020.

recycling 389k

389,000 tonnes of Reuse and hardware reused or recycled and supplies recycled, since 2019.

Reclaiming Materials

Recycling partner employee in Roseville, California, United States, disassembles HP hardware for recycling.

Forests

Conserving and restoring forests

Since 2020, all HP brand paper and paper-based packaging for home and office printers and supplies, PCs, and displays have been derived from recycled or certified sources.

14,420

14,420 hectares (35,633 acres) of forest restored or responsibly managed.18

$80M

US$80M pledged to support WWF to address the potential impacts on forests from printing with HP printers.

Forest Positive

Regua Nursery worker loads saplings for the Atlantic Forest in Brazil.

CASE STUDY:
Carbon offset

X-ELIO's Blue Grass Solar Farm is up and running today. It's been a huge project; since Salesforce signed up in 2020, 400 workers have constructed the new solar farm in the Western Downs region of Queensland.

Today, Blue Grass can generate enough electricity to power 80,000 local homes and save more than 320,000 tonnes of CO2 emissions each year. Blue Grass supports the Queensland Government's Renewable Energy Target to generate 70% of its energy needs from renewable sources by 2032, and 80% by 2035.

More information

CASE STUDY: Kyndryl partnering with customers to reduce emissions

Kyndryl has over 4000 customers who we can help to reduce their own emissions. Firstly, our emissions fall into all our customers scope 3 emissions meaning that by working to reduce our emissions, we are also assisting our customers to reduce theirs.

Secondly, Kyndryl knows that there is an even more significant opportunity to make a lasting impact on climate change by helping our customers conduct their own emission reduction projects. We believe that IT is at the foundation of many of solutions that can help our clients improve efficiency and reduce emissions not only in their IT landscape, but also in the digitization of their operations and supply chains. Examples include:

- Improving data center efficiencies and reducing energy consumption
- Migrating workloads to the cloud – cloud data centers are typically more efficient and are powered by renewable energy sources
- Digitising the workplace supporting hybrid office strategy
- Utilising AI and Automation to improve efficiency, resulting in reduced waste and more sustainable operations.

We have also developed an internal cross-functional community to share sustainability resources, provide education, and innovate new sustainable solutions for our customers. This program, Kyndryl's Green Guild, aims to drive engagement across departments worldwide; develop engagement frameworks and customer solutions, in conjunction with Kyndryl Vital (co-creation methodology) and Kyndryl Consult; and support our carbon reduction commitments. The positive ripple effect of helping even a fraction of Kyndryl's customers with their sustainability ambitions could amplify emissions reductions, helping the economy to reach net zero.

CASE STUDY: DXC Technology's Ambitious Emission Reduction Targets and Digital Futures Program

DXC has set ambitious targets for reducing our energy consumption, lowering our greenhouse gas emissions and shrinking our IT asset waste.

DXC's resolve to achieve absolute carbon and energy reduction targets aligns with the UN Sustainable Development Goals and the Paris Agreement to reduce greenhouse gas emissions and provide the foundation for sustainable, low-carbon and resilient development. In FY22, DXC reduced Scope 1 and 2 greenhouse gas emissions by 50% and electricity consumption by 33% against our FY19 baseline, far exceeding our 3-year targets of 20% reduction in emissions and 12% reduction in electricity consumption, which were established in FY19.

Additionally, DXC consumed 35% of electricity from renewable sources and recycled 99% of e-waste processed through our recycling and refurbishment partners. Given our accomplishments, we have set new 3-year targets of 55% reduction in emissions and 35% reduction in electricity consumption by FY25 against our FY19 baseline while maintaining our current consumption percentage of renewable energy. We have also committed to set near-term emissions reduction targets in line with the Science Based Targets initiative (SBTi).

The **DXC Digital Futures Program** is based on the concept of refurbishing and redistributing technology, sharing it with communities who need it the most, whilst reducing e-waste.

Access to technology is a significant indicator of socio-economic outcomes. Increasing access to technology enables better education and economic opportunities. In short, technology can have a positive social impact on communities who are remote, have limited resources or face hardships including natural disasters.

While the DXC Digital Futures Program started with laptop donations to meet the educational needs of Aboriginal and Torres Strait Islander communities across Australia, it has now expanded to communities across the Asia Pacific. The program uses sustainable practices such as recycling to meet help meet our global target of zero e-waste to landfill and support our ITAD-waste reduction commitments.

We are proud that our IT equipment is re-used for a second life and with a purpose.

Environmentally our global progress at DXC to date includes:

- >33% of all materials are recycled
- 66% of materials are resold
- <1% is disposed of

As part of the program, DXC together with its customers and partners identify opportunities to match technology donors and recipient communities where the donations will have the largest impact.

To date, DXC's Digital Futures Program has impacted over 800 students, providing technology to foundations, not-for-profit organisations, schools, community student programs, community-controlled health services and community councils.

DXC's donation partners to date include:

- Commonwealth Bank of Australia's Indigenous Business Banking team
- DELL Technologies
- ANZ Bank
- Vestone Capital
- AMP
- Origin Energy and Origin Foundation
- LiteHaus International
- Energy Development Corporation

Through these partnerships, we have donated devices to:

- Yass High School, regional NSW – 30 laptops
- Brisbane Indigenous Media Association, QLD – 12 laptops
- Umoona Community Council, remote SA – 30 laptops
- Fitzroy Victorian Aboriginal Health Service, VIC – 100+ VOIP Phones and VOIP system
- Doomadgee State School, remote QLD – 20 laptops
- Kowanyama State School, remote QLD – 30 laptops
- Ravenshoe State School, remote QLD – 30 laptops
- Ganbina Aboriginal Youth Jobs4U Program, regional VIC – 30 laptops
- Tjindu Foundation, Aboriginal Youth support program, SA – 30 laptops
- Tagai State College, remote QLD – 60 laptops
- Centralian College, Alice Springs NT - 15 laptops
- Schools in Kidapawan, Philippines – 300 laptops

"We are incredibly appreciative of the extremely generous donation of 40 laptops which will support our Aboriginal young people within our AFL Academy with completing the educational components of their studies. To be able to give our students the gift of connecting through technology assists with reducing barriers and provides them a platform that contributes to their educational success."

- Kellie Graves, Tjindu Foundation General Manager

"Together with DXC, we are so pleased to provide these students with laptops – to support their educational journey, encourage a future in STEM and help them reach their full potential. The repurposing of laptops is a simple idea, but the benefits will have a big impact - in encouraging future jobs and careers in ICT for Aboriginal and Torres Strait Islander peoples, in supporting education with technology, and in recycling technology in the best possible way."

- Ruth Lee, Origin Energy Foundation

DXC's resolve to achieve absolute carbon and energy reduction targets aligns with the UN Sustainable Development Goals and the Paris Agreement to reduce greenhouse gas emissions and provide the foundation for sustainable, low-carbon and resilient development. In FY22, DXC reduced Scope 1 and 2 greenhouse gas emissions by 50% and electricity consumption by 33% against our FY19 baseline, far exceeding our 3-year targets of 20% reduction in emissions and 12% reduction in electricity consumption, which were established in FY19.

Additionally, DXC consumed 35% of electricity from renewable sources and recycled 99% of e-waste processed through our recycling and refurbishment partners. Given our accomplishments, we have set new 3-year targets of 55% reduction in emissions and 35% reduction in electricity consumption by FY25 against our FY19 baseline while maintaining our current consumption percentage of renewable energy. We have also committed to set near-term emissions reduction targets in line with the Science Based Targets initiative (SBTi).

DXC's Digital Futures Program supports these goals by not only increasing the opportunities to re-use IT equipment, but also helping our customer and partner organisations meet their own ESG goals whilst getting involved in meaningful community projects.

EXPERT INTERVIEW: Patrick Mooney, Executive Chair, Impact Tech Ventures

What is Impact Tech and what is its mission? What is your role?
Impact Tech Ventures assists Australian sustainable technology scaleups (including clean energy, environmental, circular economy and agritech companies) to grow their business in the Asia Pacific region.

This is where the world's greatest ESG transition challenges lie. For example, 70% of the world's new energy demand by 2030 will be in this region and anyone who has been to Delhi or Beijing understands the scale of the air pollution problem. Last time I was in Delhi they broke the record with an off the scale measure and diplomats were saying they would not bring their children to the city.

Plastics pollution of cities and waterways is endemic. In India sacred cows have had to have plastic removed from their guts and e-waste is broken up by hand and often burned. The supply of quality food and water is also a major challenge, with groundwater levels dropping in India (and contaminants rising) and consumers in China having little confidence in their domestic food supply chain because of baby food deaths and extensive food fraud.

These are just some examples of the challenges and opportunities. Our goal is for Australian scaleups to have a significant impact on these challenges by 2030.

I am cofounder and Executive Chair of ITV, with the other founder being based in Hong Kong.

What is the connection of your organisation to the Asia-Pacific?
Both founders have lived and worked extensively in the technology sector in Asia and we have local partners, corporate and investor relationships across the region, particularly in ASEAN, India and Hong Kong.

Broadly, what role does technology play in reducing emissions? Why the 'tech' part of climate tech rather than just policy or law?

To achieve the reduction in emissions required we will need a combination of changed human practices, relevant technologies, policy support and independent measurement of compliance and outcomes. Singapore is an excellent example – probably the world's greenest major city, through a combination of proactive innovation, messaging to change behaviour, an easy regulatory environment and very transparent planning.

The technology piece is important because even with behavioural and regulatory change we will still solutions to deliver more power, clean water and food to meet the needs of emerging populations.

Is it as simple as reducing carbon emissions and attaining net-zero?
Achieving net zero is an important element but we actually need to reverse some of the emissions that we've created in the last 100 years. Carbon capture and use (CCU) technologies will play a role and human economic activity will have to become genuinely regenerative.

What investments are needed by corporations and governments to ensure climate tech can have the impact we need it to have?
Corporations will need to invest in new business models and supply chains, based on circularity and technologies to help them achieve that and demonstrate it credibly to stakeholders. Governments will need to support the commercialisation and deployment of Australian climate tech at scale, through mechanisms such as Accelerating Commercialisation, the Clean Energy Finance Corporation and the Reconstruction Fund. Governments can also be important lead or

reference customers for emerging cleantech companies.

How big is the potential opportunity for Australian businesses in the climate tech space? How much of this is about potential for future growth and how much is about awareness-raising in the market of what is already happening in the sector?
There is a large opportunity for Australian tech in such areas as renewable generation, grid optimisation, microgrids, battery tech, water and land remediation, sustainable agriculture and compliance measurement. There are a number of very promising scaleups and startups in these areas that do not get the same attention in the media as in some other sectors.

Is this market-driven or industry-led - are these new businesses responding to consumer demand, business opportunity, or both?
In Australia the ESG shift was led by consumers, for example through solar panel deployment (now over 30% of households, the highest penetration in the world). Industry has responded to shifts in consumer expectations and in the last 2-3 years government and policy frameworks have started to catch up. There is much greater transparency and cohesion of effort now and funding agencies like the Clean Energy Finance Corporation are playing an important role in backing climate-friendly projects.

What is taking place in Singapore and Asia more broadly in the climate tech space?
Asia is very diverse, more so than Europe and we must understand the differences. As mentioned above, Singapore is a leader in green and sustainable city development. It is also a centre of sustainable technologies investment, with a significant number of global cleantech investors having a strong presence, such as Blackrock and Everstone, alongside domestic investors such as Temasek.
Japan is investing substantially in hydrogen related technologies. Thailand is a leader in sustainable food tech and India is making massive commitments to renewable generation.

Fossil fuel exporters like Malaysia, Brunei and Indonesia are beginning the transition to renewables as they recognise the energy market shift and are modifying agricultural practices to reduce air and water pollution. Each country in Asia is charting its own path and it's important for Australian technology providers to understand where their best fit is and to work with the right local partners.

For more about Impact Tech Ventures, please see here.

EXPERT INTERVIEW: Murray Hurps, Director Of Enterpreneurship, University Of Technology, Sydney

What is UTS startups and how would you describe your role within the community?
UTS startups is a programme to reveal entrepreneurial capability in people and then to share capability between entrepreneurs. We create a lot of entrepreneurs and we support a lot of entrepreneurs and they're all tech enabled standards. We've been running five years. We've had about 1100 startups start in that time. We're supporting about 800 at the moment, helping people realise what they can do and then sharing capability so they can do a lot more.

When we're talking about the task of reducing emissions to decarbonise the economy, why do we talk about technology as such an engine in that picture, rather than just focusing on policy or legislation? What is that core philosophical role that technology is playing in global mission that we're on?
Technology makes it easier to create solutions, to create better solutions and to distribute solutions. [It enhances] your ability to solve problems and to get your solutions adopted. Australia's economic history is one of technology adoption and adaption. We don't tend to create a lot of technologies about it, but everything that's gone well in Australia more or less has been adapting technologies and creating things for the world. We're very fast adopters, good adopters. There's probably also a productivity uplift that these tech-enabled entrepreneurs possess. There's an immediate impact they have of the jobs and exports that they create, but there's a larger impact of productivity uplift on existing firms around them through them providing their solutions. The learning spill overs with so people learning things and then going to work for large companies or the competitive pressure they've placed on large companies. So in all cases, they're helping to disseminate new ways of doing things through their use of these technologies.

When you say that Australia excels adopting technology and adapting to technology, do you think that there will still be a need to create new technologies and do you think that this adoption impulse of Australians is going to be enough?
I think historicaly we just haven't been good technology creators. It's hard to argue with that and people will say we'll spend this much on R&D and we've got this educational system, but show me the examples and there's a handful of really notable examples. The rest is technology adoption. Even in the cases of 'unicorns', it's not really creating new technology. It's adapting something to a new market. I think the thought that their country as small as Australia can be a critical technology creator, I think is a little bit optimistic. When you look at Scott Morrison's speech around, he wanted Australia to be a nation that recognises ourselves as technology adopters … that speech, I guarantee, was written by an economist because it's the historical perspective on it is entirely correct. I don't think advanced manufacturing has to involve any technology creation. We are in a position to benefit a lot from new technology if we adapt them to a lithium production or battery production or solar panels or something else. But we don't have to create the technologies. We need to stop the fascination with, 'we need to do ground-breaking research for something to be a real technology that matters.' No, we don't. There's researching technology and there's making money and they are not necessarily combined.

Thinking about the green tech climate tech space, have you seen a burgeoning in this area amongst your startups? Is is there a demand in the Australian market? Is there a demand in the global market?
It depends what they're doing. I think if they're battery technologies, then yes, if they're use solutions to help companies understand something better than. They're hitting procurement walls that they hit everywhere. The tricky part is almost every company describes themselves as having a good kind of SDG impact. And then you kind of care about like, what are you optimising for? You're optimising for profitability probably. And you have this side effect.

This question of optimising for profit and then seeing sustainability factors as externalities that have to be dealt with, factors customers might care about but that are not core to the operations of what a company's doing -- have you observed a shift in the way that boards and companies are looking at what have traditionally been seen as externalities? Such as modern slavery and sustainability and net zero, to become core to what they're doing, or is it seen as an externality of compliance?
I see a lot of compliance-driven concerns about that kind of thing. However, younger founders I see on average tend to care more about that kind of thing, which is wonderful. They're more aware of today's issues because they are growing up in today's world. And that tends to get baked into how they solve things, who they hire, and the culture they build inside the company.

Is there a benefit to being a startup in the sense that you're starting from scratch in your ways of working?
Definitely. That's a beautiful thing that happens when you start with a blank canvas: you can build everything with the technologies and processes and everything else that makes sense for today. [These startups] don't have offices. They don't have desktops, they don't invest in [legacy] items that they're now stuck with. In Sydney, the vast majority of companies [with real estate] are legacy companies with legacy buildings. And meanwhile, you know, we've got 200 desks of free space here, and we'll get people coming in for half a day or a day a week. There's a real changing trend in how people work and how they utilise things. I think they are on average more sustainable.

In the early days of 2020, when the pandemic had just hit, people were already starting to think forward, to-post pandemic and ask, is this an opportunity for a global reset in how we use resources and how we work, do you think there's been a snap back from that way of thinking and things have largely returned to normal? Or do you think there has been a sizable shift in how we approach these things as governments, societies and companies?
I don't think there has been a snapback. Utilisation of space, as one example, has definitely not snapped back. Some people might pretend that it has, but I think on average it hasn't. In people's preferences on where they work, how they work, those changes are probably permanent now.

How does AI tie into a future state of what reducing emissions could look like?
AI really accelerates the and the technology integration and innovations, suddenly bringing the cost to reengineer something close to zero. Suddenly, a lot of things will make sense. It didn't make sense before if the cost to produce it using some advanced manufacturing technique is now a lot less. The monetization of labour will make a lot of technology adoption faster.

Do you think that it's market-driven and consumer driven or is it more industry-led; are organisations going out there on a limb or can they see the customers are there and we're just going to respond to their demand?
A lot of it is people following information on market trends for understanding that there's an unprecedented going to shift in where money will be spent and understanding. They're saying, "OK, there should be at some point a giant opportunity here and here and here and applying technologies they've got or solutions they've got to that." But you can have great solutions, but if people are not ready for it, there's a timing issue. Their timing is perfect in anticipating a giant shift, but it's hard to see it before it happens.

What can we be doing in Australia from a government perspective, to produce the environment for startups to turn into scale ups and thrive and receive investments?
You have to respect the economic climate of Australia. Asking, 'What kind of 'crops' grow in our economic climate and how can we plant more?' Traditionally, it hasn't been an environment where highly venture capital-dependent companies have done extremely well in large numbers. So we can't just reproduce the VC environment of the hotbeds of the world. And we're not going to, even if we come out and try. But we do have other advantages here in terms of the amount of space that we have, the kind of resources that we have and how technologies might be applied to those resources. The largest lever I think government has that can really impact an industry like this is the availability of talent. They hold most of the levers that can redirect what people study and who is led into the industry. Both are difficult levers to pull, but there's a lot of research to support that. If you allow a lot of immigration and skilled people, or drive an increase in the availability of education in these areas, then you can make a really meaningful difference to these industries.

For more about UTS Startups, please see here.

EXPERT INTERVIEW: Professor Tim Boyle, Director Of Innovation, Ansto

Can you explain briefly what ANSTO is and what your role is within the organisation?
ANSTO is a publicly funded research agency. We operate most of Australia's landmark scientific research infrastructure such as the Open-pool Australian Lightwater (OPAL) Reactor and the Australian synchrotron, the Australian Centre for Neutron Scattering, and other specialised capability platforms that use nuclear technology to solve the world's biggest problems. We also manufacture nuclear medicine, we irradiate and supply over 70% of the global demand for NTD silicon, which is used for high end semiconductors.

I serve as Director of Innovation and Commercialisation at ANSTO is to and look at opportunities across our intellectual property and how we commercialise this IP. This includes how we take the outcomes of our research and disseminate it for impact beyond traditional academic and research stakeholders. I also direct the nandin Innovation Centre – which is the hub of the ANSTO Innovation Precinct. nandin is a 1200 square metre facility; we have a community with just over 40 science based innovation startups. It is home to ANSTO's graduate institute with PhD students that come to work in collaboration with ANSTO from all Australian and New Zealand universities, and we are anode of the Design Factory Global Network – a network of leading innovation centres around the world. ANSTO has two campuses, with our main campus at Lucas Heights serving as a globally significant innovation precinct with over 5000 international scientists and innovators visiting annually to access our science and deep technology infrastructure.

In March 2022 ANSTO agreed to its Environmental Sustainability Strategy which will take the organisation out to 2035. There are 10 goals including net-zero scope 1 and 2 emissions by 2035. What will it take to get there and how has this Strategy been taken up by the broader ANSTO team?
We're starting to the see the impacts of the implementation of the Strategy already. We're reducing waste by simple measures such as removing rubbish bins from individual workspaces and having common ones. It's creating conscious thought about creating waste and using paper. There's been a review of printers onsite and a reduction in the number of printers. We've moved away from single-use items in our café, especially single-use plastics. We're now investigating future-proofing regarding our campus project – with electric vehicle charging stations and reducing emissions by future-proofing and baking into any projects moving forward sustainability measures through to 2035.

I note ANSTO holds certification under ISO14001 for Environmental Management Systems. What are the unique considerations in managing environmental impact for a research facility operating in a bushland context at Lucas Heights?
There's two facets – a general facet around normal environmental monitoring to make sure we're not creating a footprint for the environment worse than the one here beforehand – the second is that because of the nature of the work we do being in the nuclear space – is to ensure that there are no detrimental environmental effects from radiation or our nuclear operations. We have monitoring and compliance to ensure that we are operating safely and sustainably. ANSTO has come on the journey with community

expectations. The area was originally a dumping area for Sydney. We have the Lucas Heights Resource Recovery Park, the largest tip in Sydney. Up until the 1950's Sydney's night soil was also dumped out here. Back then Lucas Heights was beyond the outskirts of Sydney and was where we took waste and industrial by-products. Now with ANSTO here we're managing the landscape. While didn't inherit a pristine site, we are doing our best to make sure that it is better than when ANSTO arrived.

As a committed contributor to nuclear stewardship and monitoring radioactivity, I know ANSTO is out there on the global stage forming strategic partnerships. What role will nuclear stewardship play amongst our near neighbours in the Pacific and Southeast Asia?
ANSTO is a member of the International Atomic Energy Agency (IAEA). We operate with a goal to be an exemplar of safe and sustainable nuclear practice. With respect to the environment, there is significant debate about the role that nuclear power can play in energy transition. However ANSTO does not conduct nuclear power research, or operate a nuclear power reactor. ANSTO acts under the policies of the government of the time and currently nuclear energy has been legislated against. ANSTO does however, provide advice to government on new and emerging technologies in the nuclear space, which does include new energy technologies such as small modular reactors (SMR's) and fusion reactor technologies. With AUKUS, we are currently supporting defence and providing advice to government on aspects of training and developing a nuclear workforce to support the nuclear-powered submarine program.

I am fascinated by the validation of Indigenous understanding of seasons achieved by ANSTO's scientist using radon observations. What does this say about the link between nuclear capability and a deeper understanding of the world around us?
This project comes from using our radon detection technology. We are a global leader in developing these radon detectors and sold over 40 globally. What nuclear science- not all nuclear science is making reactors and operating nuclear reactors and making nuclear medicines. There's a whole suite of research infrastructure, capabilities and techniques using nuclear science-enabled capability as a tool for solving bigger problems, characterising radon levels in the environment or measuring the amount of carbon dioxide in the atmosphere across historical times. Analogous technology is accelerator mass spectrometry and carbon dating. In regards to the classic graph made popular by Al Gore – CO2 and time, we had only been able to measure directly the last 100 years or so of measurements. Most of those were done at Cape Grim by the CSIRO – a station in Tasmania. ANSTO in collaboration with others have taken core ice-core samples from Antarctica. The air bubbles trapped inside the ice is like a time capsule. We extract the gas from those bubbles and do mass spectrometry and can determine in our graph what the relative concentration of CO2 in the atmosphere at those points in time. That's how the historical information comes into that graph.

How does ANSTO's nuclear capability plugs into understanding climate variability, the carbon cycle and the impacts of human migration patterns?
We also use similar accelerator mass spectrometry technology to understand the amount of carbon particulate in the atmosphere. Engine emissions, especially diesel emissions and coal-fire powered stations release black matter into the atmosphere. With Multi-wavelength absorption black carbon instrument (MABI), we commercialised with a local manufacturer, and this technology is used for taking carbon sample measurements of particulate. We've got more than 30 years of longitudinal data from these instruments. You can monitor changes in the environment on the changes in particulate – black carbon in the atmosphere. This sheds light on the environmental impact of certain industries and vehicles and the effect of bushfire.

One aspect of managing environmental footprint is in the management of water by governments and local communities. What is it about nuclear capability that helps with that ambition?

We also do a lot of work in understanding the flow of water in aquifers. We can work out how old the water in the aquifer is, and measure how long it takes for those aquifers to replenish. For example if an aquifer is going to be accessed for irrigation or another industrial use, you don't want to tap into one that takes over 10,000 years to replenish. We undertake this work by measuring naturally occurring radio isotopes within those aquifer systems.

ANSTO has powerful facilities that enable isotope tracing in natural systems, which can assist research and industry. Can you explain what this tracing is and what are some examples or ways that these facilities supercharge the analysis of natural systems for the benefit of clients?

A great example of how we use this technology, and that is in determining food provenance. Currently we have a number of partners we are collaborating with to support country of origin labelling and prevent fraud in food and seafood markets. Our technology combines isotopic and elemental analysis in a unique way which allows us to determine if a fish or a prawn is indigenous or if is being farmed overseas and imported to Australia. This technique can also be applied to make informed decision for biosecurity as well as food waste and fraud. We are currently commercialising this technology, and one of our lead partners is the Sydney Fish Markets. We are sampling imported produce versus local produce which helps aid consumer confidence that when you buy a product that is labelled as being of Australian origin, it has actually been caught locally.

We are looking at the years of 2030 and 2050 and a future-state for how technologies will be able to assist in achieving sustainability goals. Are there any developing or future areas of nuclear capability you are really excited about looking out to those years?

The adaption of nuclear technologies by convergence with other systems is really exciting. As we move to a hydrogen energy economy, nuclear technologies are some of the cleanest ways of making hydrogen at scale. We talk about green hydrogen – hydrogen is very dirty – it comes from steam reformation and oil production – and is quite a dirty technology. Green hydrogen is the holy grail but difficult to produce on an industrial scale through water hydrolysis, but you can use the heat from nuclear reactors to generate hydrogen. That's a non-carbon-emitting form of hydrogen production. We do a lot of research into understanding what makes high-performance energy storage and batteries using different rare-earth materials. The sufficiency of battery storage materials and using nuclear techniques to understand them is exciting, as are small modular reactor technologies for nuclear power. Nuclear waste is what everyone's concerned about. New reactor technologies are being developed that produce energy from the waste forms from legacy reactors or previous generations of reactors.

For more information about ANSTO, please see https://www.ansto.gov.au/

EXPERT INTERVIEW: Mick Liubinskas, CEO and Co-Founder, Climate Salad

What is Climate Salad and what is its mission?
Climate Salad is a community of Australian climate tech companies and we help them solve global environmental and sustainability problems through a comb of our network, tools and programs. We focus on trying to help the entrepreneurs building climate tech companies – finding talent, building product and meeting investors. We have a big focus on international expansion. Australia is a big country but a small market. We focus on helping Australian climate tech solutions get into international customers' hands. We do trade missions. We are hoping to set up an early-stage fund for climate tech.

We have heard of late about an economic slowdown and the bursting of the 'tech bubble' when it comes to investments. How has this affected climate tech startups and entrepreneurs? Is this section of the industry resilient?
It is a new industry. It's coming from a lower base. It's resilient for a few reasons – one, because it has to be; we can't allow a lull in the market to derail our efforts to remain below 1.5 degrees increase. Secondly, a number of new firms have allocated and raised capital for climate tech investing, as there's a lot more dry powder. While other sectors have more overall powder, as a subsector that's a reason it's resilient. The other reason is that corporate engagement in climate as a new sector is significantly bigger than any other sector I've seen. They see both the risk of failure to participate but also the benefit of participation in all industries but especially in high-carbon-emitting industries like aviation, oil and gas, agriculture, food, transport. Climate touches bits of everything.

What are the challenges and opportunities in seeking to export or expand overseas versus seeking customers in the domestic market?
Typically, in my experience and that of hundreds of companies I've worked with, Australian corporates are very rarely early adopters of new technologies. Australian government is typically lagging behind that. That isn't always the case. The joke in Australian tech startups is that to get an Australian customer it's a two-step process – first getting a US customer then coming back to Australia. Australia is one of the last companies to get the benefit as it's not a big enough market to target. There's appetite in climate to get Australian pilots but it's not going to happen without significant incentives. It would materially make a difference, keep jobs in Australia and make advanced manufacturing sectors. It's not taking on unwarranted risk. We need paid pilots but with government and corporate. It has to be 2-for-1 matching. It takes me ten times longer to get a ten times smaller pilot in Australia than in US, Europe or Asia. My default response is don't even try. Because climate tech is 80% hard tech, it is much harder to launch overseas. I have Goterra maggots and a thermal brick in my car as we speak. You need special permits to take them overseas. It's a circular reference, either positive or negative. If positive, we create climate solutions, export dollars and local dollars. If we don't, we lose it all. We have Ripe Robotics who are testing their products in Shepparton farms picking fruit with robots but once they get it picked, they're taking their technology overseas because they can get 100 customers in the US where they get 1 in Australia. The capital follows the customers. Mechanical engineering and support jobs are potentially going to be lost. We shouldn't be aiming for 100%, but we should be aiming for better than currently.

Broadly, what role does technology play in reducing emissions? Why the 'tech' part of climate tech rather than just policy or law?
When we think about the job to be done, if we're going to get to sustainability, we need to do a number of things. We need to reduce the emissions that are going out. If we've got a bathtub that's overflowing, that's turning down the tap. At the moment, the tap has been increasing flow with each passing flow. We at least have to stop increasing the flow, this is EV, solar, wind, and eating less meat – reduces emissions. To do those things we have a lot of existing technologies. It's also behaviour and policy. That one doesn't need massive amounts of policy and behaviour change. But if we think about trying to reduce emissions for shipping containers and for planes and buses and trucks and trains and agriculture, then that does not need new technology. There's a mix there.

The second kind of impact we have is we have left it too late to just reduce emissions; we need to remove emissions. We need sponges in the bath. We need to soak up the water on the floor. [That includes] carbon capture and storage or use. Carbon sequestration for a trillion new trees that we don't have room for. But we also need to use other technologies to remove carbon dioxide, nitrous dioxide, methane and water vapour from the air as greenhouse gases. They need different technologies. We also need to invest in carbon capture and storage.

Carbon capture and storage will not save us. But it will save things getting a lot worse and help us get to sustainability. But by itself it's absolutely and utterly nowhere near enough. It's the equivalent of saying I'm going to keep playing my soccer game even though I've broken both my ankles because I've got Band-Aids on them. You'll feel better over time, but your ankles are still broken. No amount of sequestration and storage will be enough if we keep emitting as we are now. Turn off the tap. Soak up the water. Left both too late. We also need adaptation technologies – Queensland technologies are world-leading in terms of predicting, managing and recovering from floods. We need bushfire technology. Sea-level rise technology. Energy security, food, water, air. Adaptation is the third type.

The fourth is natural capital. We've cared about money for thousands of years and have millions of accountants around the world. We need people caring and valuing the environment that keeps us alive in terms of flora, fungi, fauna, microbes, air, water, kelps, coral, everything and caring about that, understanding it, loving it, nurturing it, looking after it. That's the fourth kind and we need all kinds of technology for that. We have robots out of the Great Barrier Reef developing ways to plant new coral and we need to be able to do that and grow our natural assets much better. Bill Gates' book has a useful structure for thinking about the industries. Sometimes we think about agriculture or energy or transport but what Gates' model suggests is that we need to do powering, growing, making, moving and cooling/heating.

We need people and companies to change behaviour. People often think they don't count or add up to enough, but every person is not just a voter but also a consumer, an employee and an investor – [which is relevant to] banking and superannuation. Those four pressures have actually led to corporate pressure because future super is one of the fastest-growing super funds. One luxury I've had is to sit between this industry and 350 climate tech founders and the rest of the world. I've been able to watch and support them and act as an API between them and the industry. In our 2023 Industry Report we talk about how this industry from Australia to the world is changing things.

Is it as simple as reducing carbon emissions and attaining net-zero?
I'm halfway through a Masters of Sustainable Development and the main thing I've got an understanding of is it's a lot worse than I thought when I started. We need to be trusting and paying these scientists a lot more. People say, "How can water vapour be a greenhouse gas?" To try to grasp it all- I've got barely 1% of the understanding. How do you create a narrative that gets people's attention because clearly it hasn't been working so far. 2050 sounds far away. Even as a dad of young kids it seems forever away. The narrative is really hard. We believe in supporting entrepreneurs because their job is to not just go to where the

customer is and just do what they want. It's to create a new product and a new possibility and make that so much better. When you think about mid-west America – if they had a burger tastier and cheaper than a hamburger they'd eat it. We have to create better products. That goes to the point around carbon – energy and carbon get the lion's share of the conversation but they are only elements of it. It's way too complicated to engage people on everything. It's really difficult and I don't know the answer and at times we simplify other times we go for deeper. Institutions that do understand it aren't trusted anymore; there's a lack of trust. Government can play a role in building the world's trust.

I have been lucky enough to reduce my meat intake. If we all reduce our meat intake that makes a big difference; cows produce ridiculous amounts of methane. If you feed cows seaweed, they reduce their burping. It's a bit like the carbon capture and storage. I really appreciate every person. I don't think you need to be throwing soup onto artworks or blocking the roads, but young kids can be very frustrated by the situation. I think the challenge with finding the middle ground is there's probably 30-40 trillion dollars of assets that are not going to naturally benefit from climate without change. Based on capitalism and motivations and greed, to get to balance, we need another 50 million people to eliminate their meat intake. If you present the situation as two options, totally vegan, no car, never travel; you won't get anybody taking steps in a positive direction. There is a book by Rebecca Huntley called How to talk about climate change in a way that matters. She's done a lot of research about 8 different groups of people between totally and utterly passionate and committed to deniers. Talks about what psychological methods work to move people from one group to another. She talks about fear, hope, guilt and greed. The fact that we need mix of all of those. We need more people in the middle. At the moment to counterbalance, you've got absolute deniers eating a hamburger till the day they die and 1 billion people without access to cleaner water, education, democracy. They certainly can't be held responsible for sustainability.

For more about Climate Salad, please visit https://www.climatesalad.com/

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